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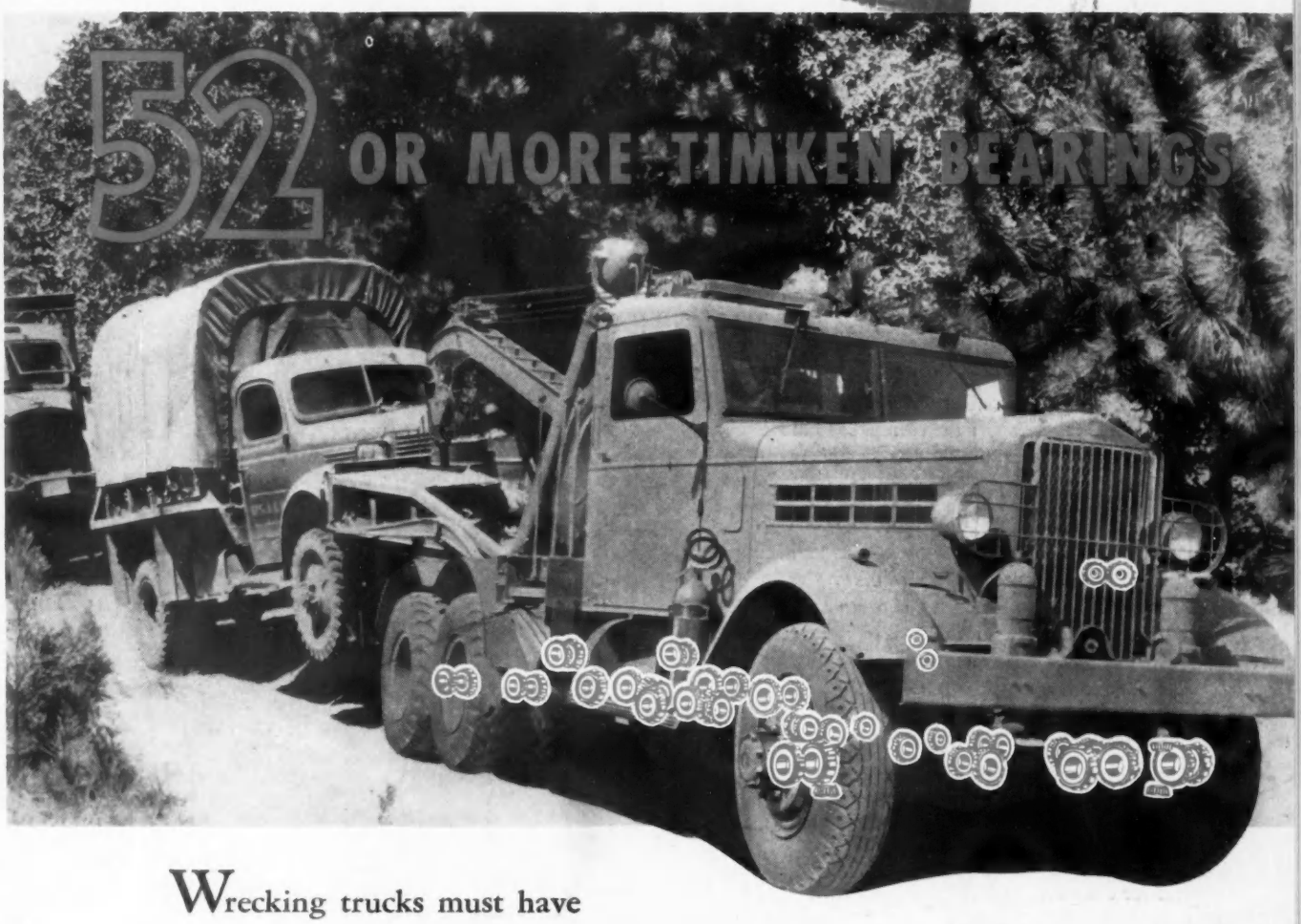
AUTOMOTIVE and Aviation INDUSTRIES

SERIAL RECORD

MAY 15, 1944 MAY 22 1944



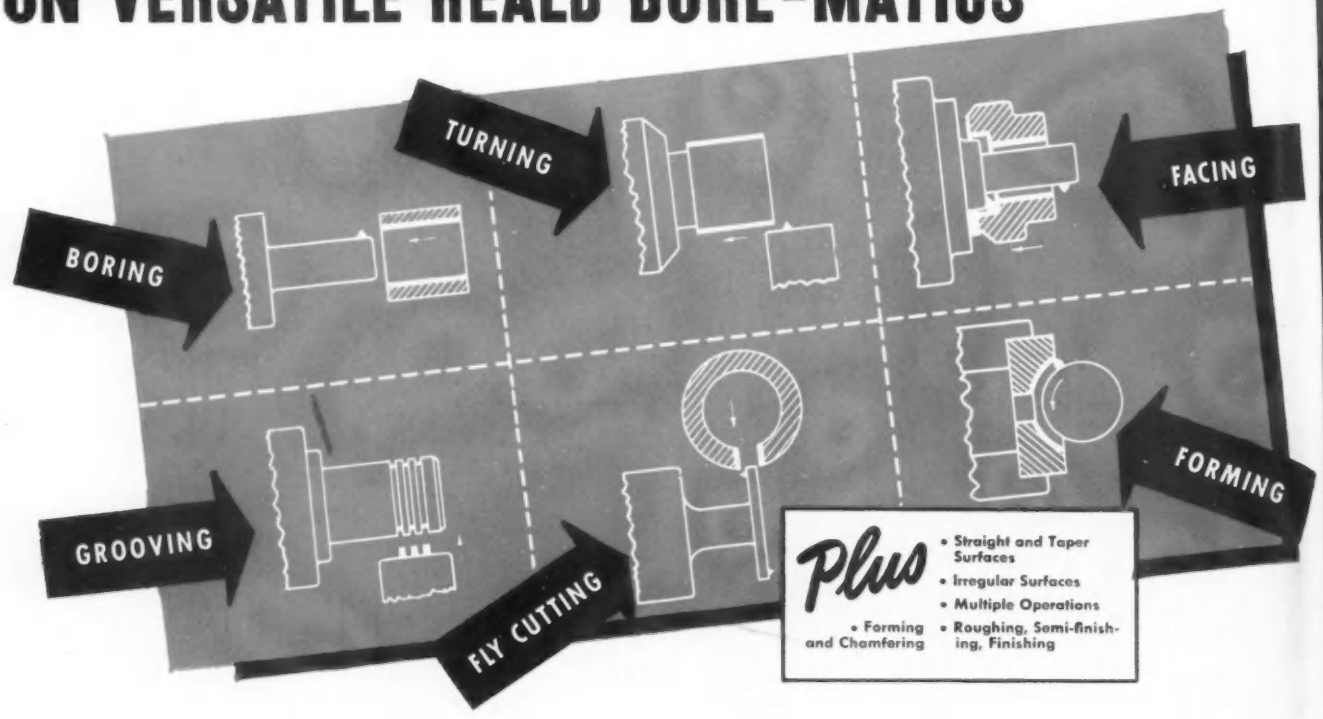
Wrecking trucks must have stamina. Those designed for military use are able to move almost any disabled unit which blocks the road to the front. Six by sixes with a total of 52 or more Timken Bearings are common. Engineers who are designing vehicles for peace time use can do no better than to include Timken Bearings in every possible position.

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

MAY 20 1944

Do all these Precision Jobs
ON VERSATILE HEALD BORE-MATICS

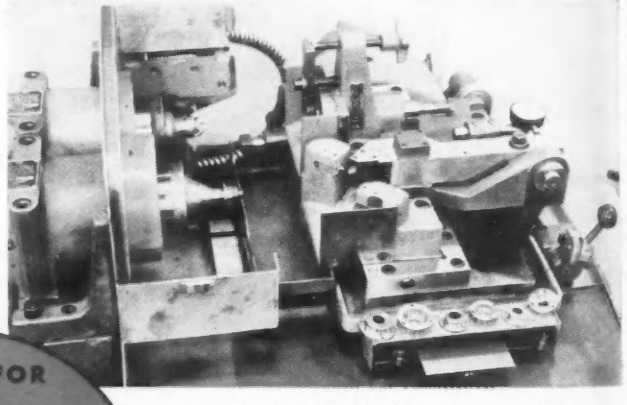


V. F. 1* *ALL-PURPOSE* VERSATILITY *FOR ALL APPLICATIONS*

Here's a way to hold size, roundness, straightness to tenths . . . get perfect squareness, concentricity, alignment . . . produce better finish, reduce or even eliminate final lapping and honing . . . boost production, lower costs . . . *this way*—Borize on *Bore-Matics.*

Such results are not limited to just one type of operation. Heald Bore-Matics are all-purpose tools—for all kinds of jobs, for all types of operations. Unusual flexibility gives them unusual *versatility*, makes it possible to execute boring, turning, facing, chamfering, grooving with equal efficiency. Either straight or taper surfaces can be machined, and also curved and irregularly-shaped surfaces. These operations can be accomplished singly, simultaneously, progressively or in combination. Nor are operations restricted to final finishing—roughing and semi-finishing can be done, too.

Heald Bore-Matics can help you meet postwar competition, aid in creating new postwar markets—thru more precision, more production on all vital operations. Get the Bore-Matic story, now . . . The Heald Machine Company, Worcester 6, Massachusetts.



Borizing Gun Housings. Six operations—turn, face, chamfer, bore. Two stations. Single end operation. Rotary and stationary fixtures. Compound feed, table and cross-slide. Automatic cycle. Such versatility in Bore-Matic design permits ready adaptability to the exact requirements of every job.

LOOK FOR
*V. F.
"VERSATILITY FACTOR"
in your Post War Tools

V. F. 1—Application
V. F. 2—Function
V. F. 3—Tooling
V. F. 4—Fixtures

HEALD *Bore-matics*

THE MOST VERSATILE MACHINE TOOL

Battle-front Refrigerators

ON WHEELS!

Acme Photos

Sgt. E. P. Golomski of Milwaukee, Wis., and Pvt. C. Lucas of Hammond, Ind., at the controls of the Waukesha Engine-Driven Refrigeration Unit

● It isn't *always* K rations up at the front lines. Not when these G. I. refrigerators go rolling along. Here are some of them on the move in the European area.

No matter how long the supply line to the front may be, their loads of fresh meat and green vegetables, life-saving blood plasma and other precious medical stores will arrive in prime condition. The Waukesha Engine-Driven Refrigeration Unit takes care of that. Dependability is built in—and how well Waukesha *knows how* to build it in.

Waukesha *know-how* was gained from years of building mobile engine-driven air conditioning and refrigeration equipment. Equipment that proved its dependability over millions of railway and highway miles—despite constant variation, sudden changes and wide extremes of temperature.

Today all Waukesha *know-how* goes into the war effort—and all Waukesha production goes to the armed forces. After the war Waukesha mobile engine-driven refrigerating units . . . still further proved *and* improved . . . will be ready for mobile commercial applications of every type.

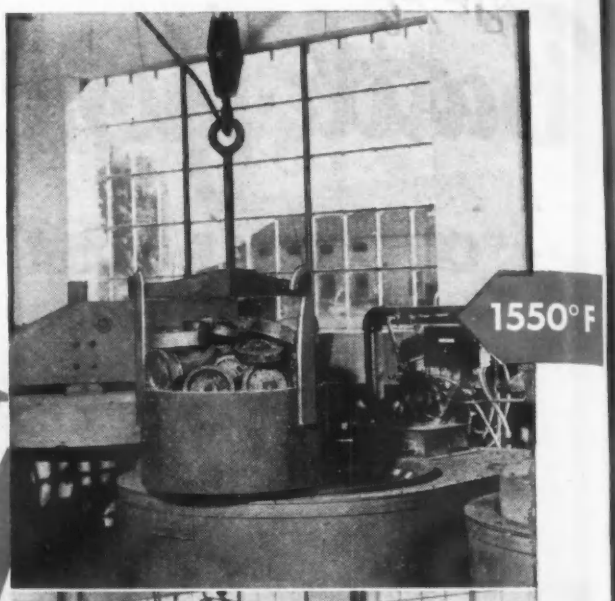
WAUKESHA MOTOR COMPANY, WAUKESHA, WIS. • NEW YORK • TULSA • LOS ANGELES

MORE POWER FOR VICTORY

WAUKESHA ENGINES

Versatile!

The Lindberg Super-Cyclone Furnace



For all metal treating, utilizing heats from 300° to 1750° F., the Lindberg Super-Cyclone Furnace gives complete versatility.

For instance, in the photographs here, a charge of gear blanks is just going into the Super-Cyclone at 1550° F. Next a load of gate valve weldments is being charged for stress relieving at 1100° F., and below, 16 railroad frogs are lowered into a temperature of 700°F. for tempering. All using the same Super-Cyclone Furnace!

When a load must be reheated at a lower temperature, after quenching, the Super-Cyclone can be accurately brought down to the proper heat while the load is in the quench, saving precious time and rehandling.

The Super-Cyclone operates on a principle of fan driven hot air from an isolated heating chamber racing at high velocity through the most compact load to build up temperature with rapid uniformity. This allows temperatures to be built up or reduced with amazing speed. And there is a complete avoidance of radiant heat that causes distortion.

This revolutionary heating principle saves time and space, keeps work straighter and cuts production costs. Write for complete information to Lindberg Engineering Company, 2446 W. Hubbard St., Chicago 12.

LINDBERG FURNACES

ARMY NAVY

SUPER-CYCLONE for hardening, normalizing, annealing, tempering
CYCLONE for accurate, low-cost tempering and nitriding
HYDRYZING for scale-free and decarb-free hardening

AUTOMOTIVE and Aviation INDUSTRIES

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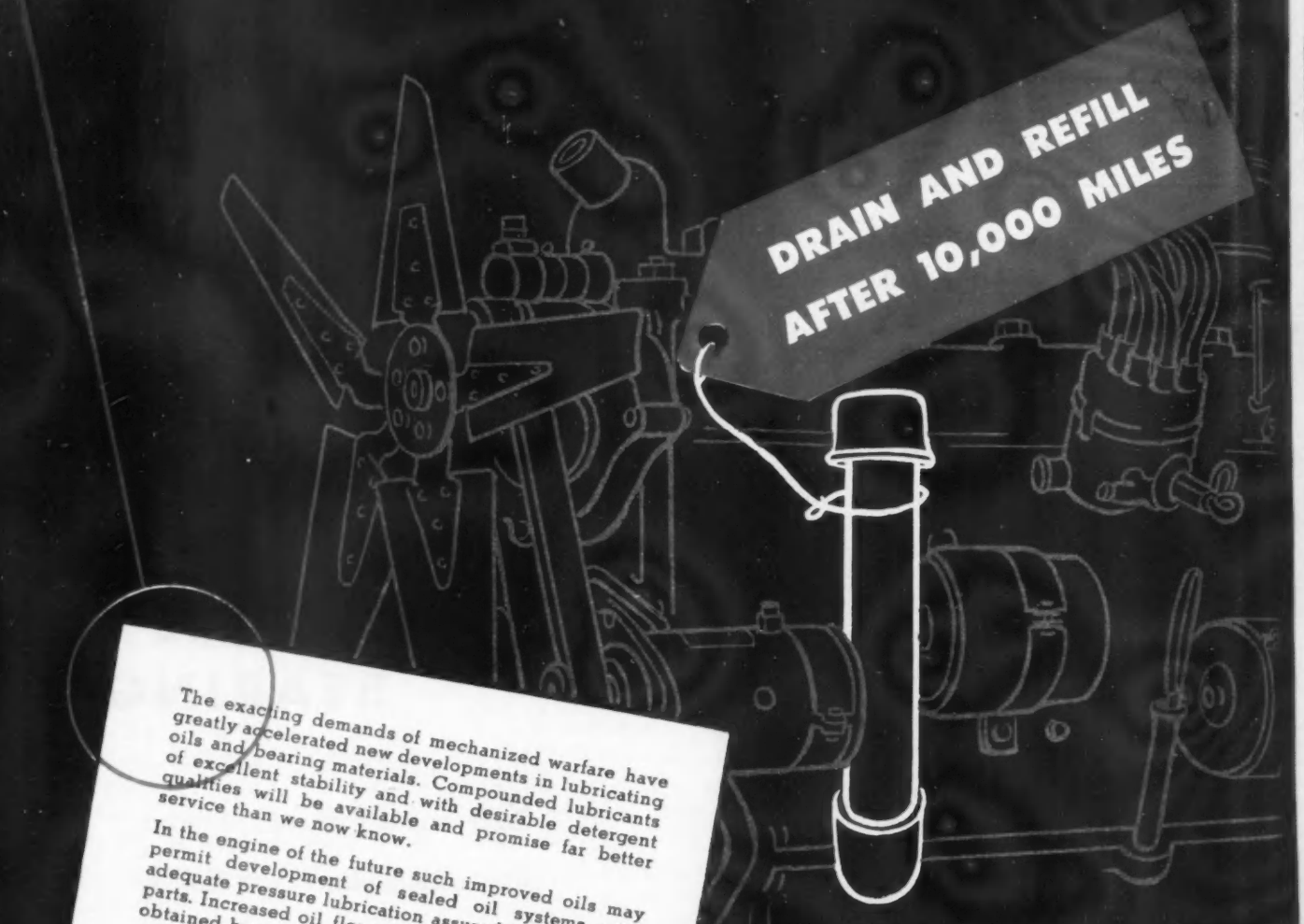
WILL OIL SYSTEMS BE SEALED AND PRESSURIZED?



The exacting demands of mechanized warfare have greatly accelerated new developments in lubricating oils and bearing materials. Compounded lubricants of excellent stability and with desirable detergent qualities will be available and promise far better service than we now know.

In the engine of the future such improved oils may permit development of sealed oil systems with adequate pressure lubrication assured to all moving parts. Increased oil flow and better cooling may be obtained by proper thermostatic regulators. Refinements in filtering may maintain lubricant quality for many times the length of service now possible. Sludge and lacquer formations will accumulate so slowly that lubricating systems, sealed for a season or longer, may be entirely feasible.

If such sealed oil systems should become a fact, much of the responsibility for maintaining oil quality will depend on piston rings of improved material and advanced design to control blowby and reduce oil consumption. These, and all other problems of piston ring manufacture for the engine of the future, are constantly under discussion and research by Muskegon engineers and metallurgists.

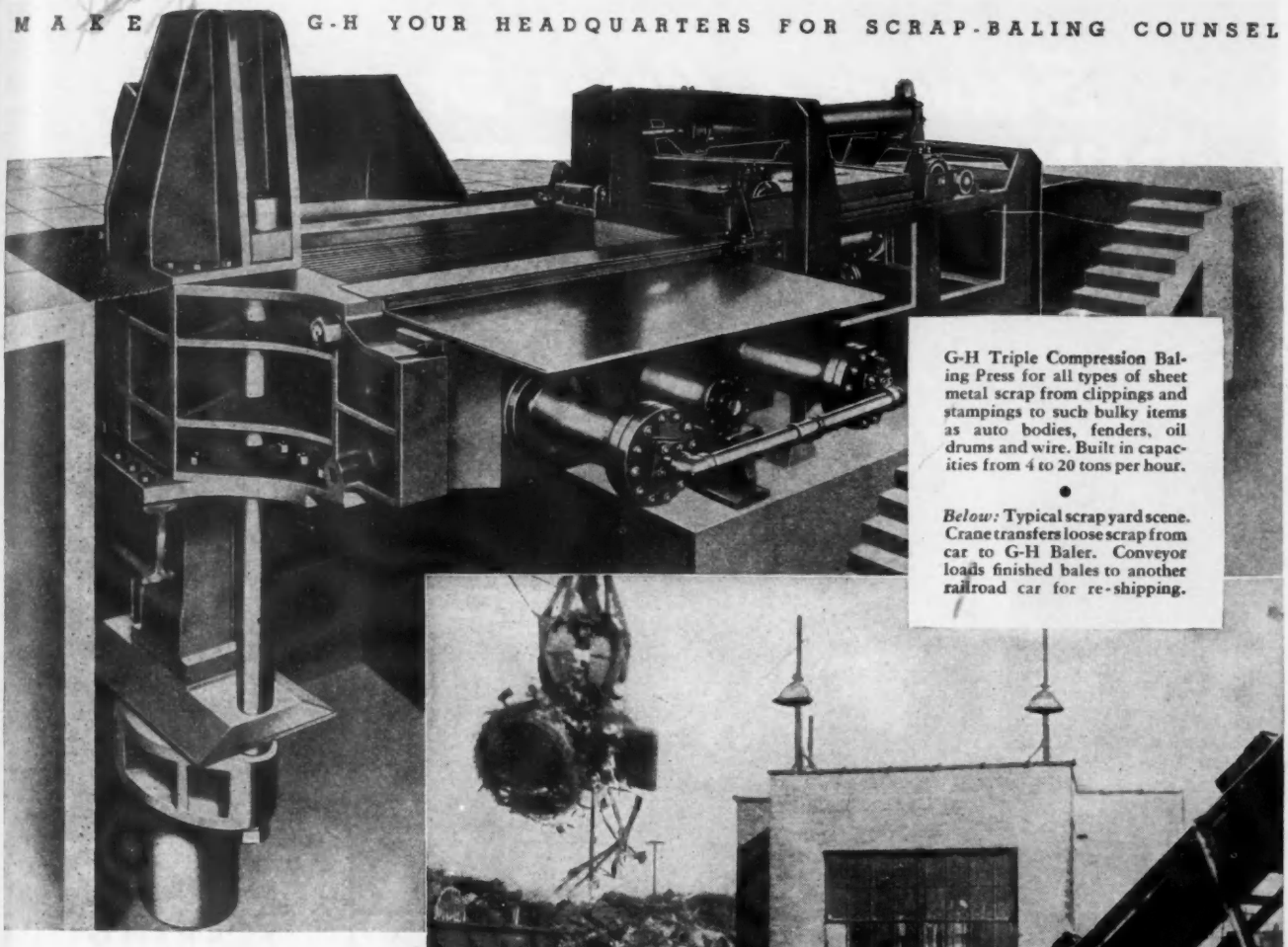
Muskegon's vast experience in designing and producing piston ring castings and finished piston rings for all types of engines—aircraft, automotive and industrial—is the practical background of Muskegon engineering. Consult Muskegon now concerning any piston ring problem.

Buy an EXTRA War Bond

MUSKEGON
Piston Rings

MUSKEGON PISTON RING CO.
MUSKEGON, MICHIGAN
Plants at Muskegon and Sparta

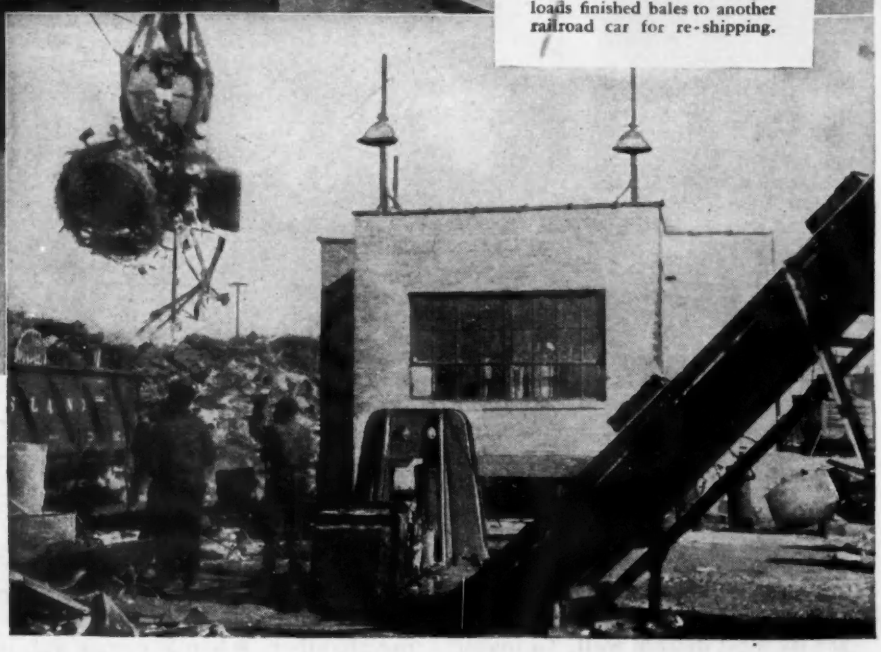
MAKE G-H YOUR HEADQUARTERS FOR SCRAP-BALING COUNSEL



G-H Triple Compression Baling Press for all types of sheet metal scrap from clippings and stampings to such bulky items as auto bodies, fenders, oil drums and wire. Built in capacities from 4 to 20 tons per hour.

●

Below: Typical scrap yard scene. Crane transfers loose scrap from car to G-H Baler. Conveyor loads finished bales to another railroad car for re-shipping.



THERE'S plus VALUE

in ALL TYPES of SHEET METAL SCRAP . . . when it's Baled the G-H Way!

The industries which have made the most valued contributions to the scrap-salvage program are those equipped for high-speed, low-cost baling of *all types* of sheet-metal scrap. In hundreds of such plants, G-H Hydraulic Baling Presses are producing tremendous volumes of dense, mill sized bales to help keep the steel mills going at top capacity. If you want to increase the value of your Scrap-for-Victory, bale it the G-H Way! There's a size and type of G-H Hydraulic Baling Press for every baling need.

GALLAND-HENNING MFG. CO., 2747 S. 31st St., Milwaukee 7, Wis.

GALLAND-HENNING

SCRAP METAL BALING PRESSES

A 4325-1P-R

Examine a Cross Section of
BUNDYWELD STEEL TUBING

Get a Close Look at Its Solid Double Wall

With Bundyweld under the glass, you immediately see its solid double wall. To make this tough tubing, Bundy rolls a single strip of copper-coated S.A.E. 1010 steel twice around laterally into tubular form.

The tube is then passed through a brazing furnace at just the correct temperature to insure a perfect bond between the copper and steel.

Oxides cannot form in the brazing process because the atmosphere in the furnace is so carefully controlled. The tube goes from the brazing furnace through a long cooling chamber. When it comes out, it has a fine mirror-like finish, both inside and out.

Bundyweld is furnished hard or annealed, in a wide range of standard diameters and gauges up to 5/8" O.D. Special sizes cold drawn as desired. Also furnished in Monel.

Bundy engineers are ready to help you solve your tubing problems for the products of peace. Write Bundy Tubing Company, Detroit 13, Mich.

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Operation No. 1

In hydraulic brake lines and in all lines where there may be over-torqueing or where higher pressures are carried Bundy recommends the double flare illustrated here.

This double flare gives almost twice the amount of metal at the seat and safely permits frequent removal and replacement of fittings, as well as over-torqueing. It is held to close tolerance and is leakproof.

Operation No. 2

"FAMOUS LIFE LINES" FOR WAR AND PEACE

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ENGINEERED TO YOUR EXPECTATIONS

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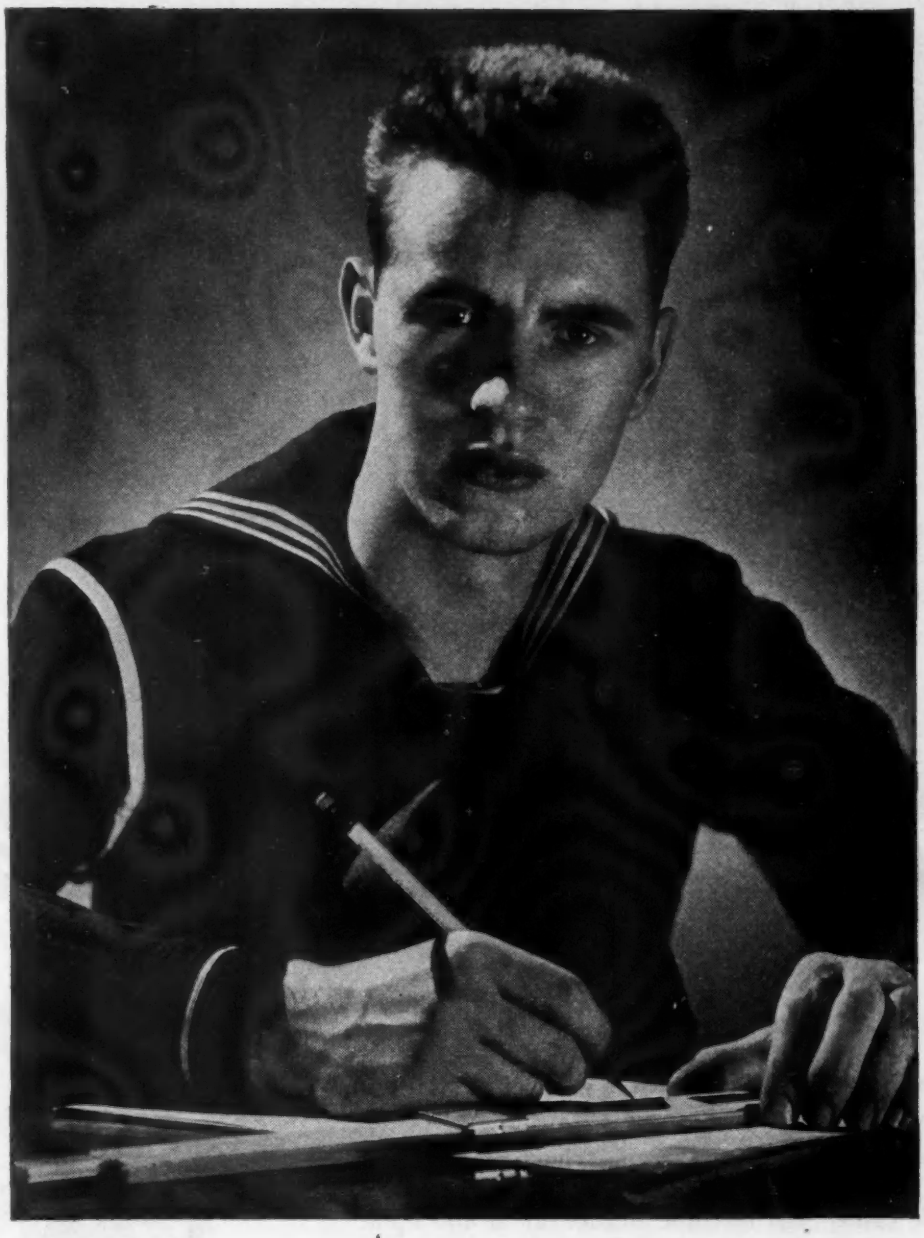


The man behind the Future

Behind our fighting forces is the greatest production effort in the history of the world.

Behind our production effort are the men of science... engineers, designers, researchers, mass-production experts.

Behind these mechanical wizards are the engineering students... the men of tomorrow on whose shoulders rests America's industrial future... your future.

These young men... many already in uniform... are passing up their football and hockey and best girls to cram four-year engineering courses into less than two years.

They are getting behind the war effort. The things they've learned are already at work in America's planes, tanks, guns, and ships.

And behind these students... with endless patience and devotion, giving freely of their minds and hands and time... are the veteran teachers.

Also backing them are America's leading industrial organizations... taking time, though busy on war jobs, to help these youngsters foresee the use and shape of future mechanical equipment.

Hyatt, for instance, regularly provides data of helpful interest for these knowledge-hungry engineers.

Our latest contribution is the Hyatt Engineering Handbook... a quick-reference manual containing a collection of original computations and other fundamental engineering data.

Such is the American way of getting things done, of planning ahead, of imparting knowledge to builders of tomorrow, of cultivating coming men as well as those who have arrived.

We've all got a stake in these young men. The stake is our future... America's future.

Let's give them all we've got.

HYATT BEARINGS
DIVISION OF
GENERAL MOTORS
HARRISON, N. J.

A 35-SECOND RECIPE FOR CLUTCH PLATES

Any housewife, just enlisted in war work, can understand this!

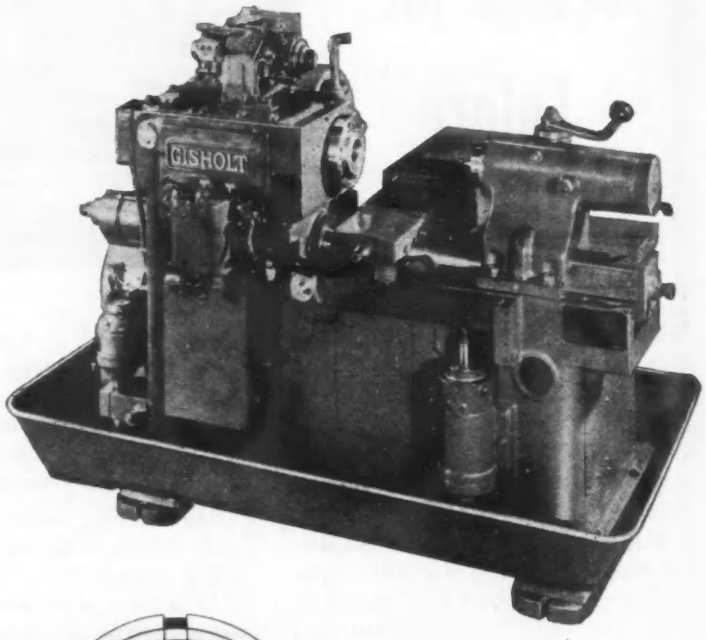
Take the rough casting for an 8" clutch pressure plate and place in the chuck of a Gisholt Hydraulic Automatic Lathe. Start machine and let run at 400 r.p.m. with .005" feed for 35 seconds or until machine automatically stops. Remove finished plate which is ready to serve on a jeep.

It's as simple as that with the Gisholt Hydraulic Automatic Lathe. And it's typical of the way many inexperienced workers are producing a wide variety of parts quickly and accurately to meet the demands of war production.

Gisholt engineers are ready to help you apply the speed and simplicity of the No. 12 Hydraulic Automatic Lathes to your own specific problems in large volume machining. Write for complete information.

GISHOLT MACHINE COMPANY
1205 E. Washington Ave. • Madison 3, Wisconsin

Look Ahead—Keep Ahead—With
Gisholt Improvements in Metal Turning



GISHOLT

THE GISHOLT HYDRAULIC AUTOMATIC LATHE *is adaptable to a wide variety of between-centers and chucking work. It provides high speed multiple cutting with extreme accuracy. One operator usually tends two or three machines.*

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES • SPECIAL MACHINES

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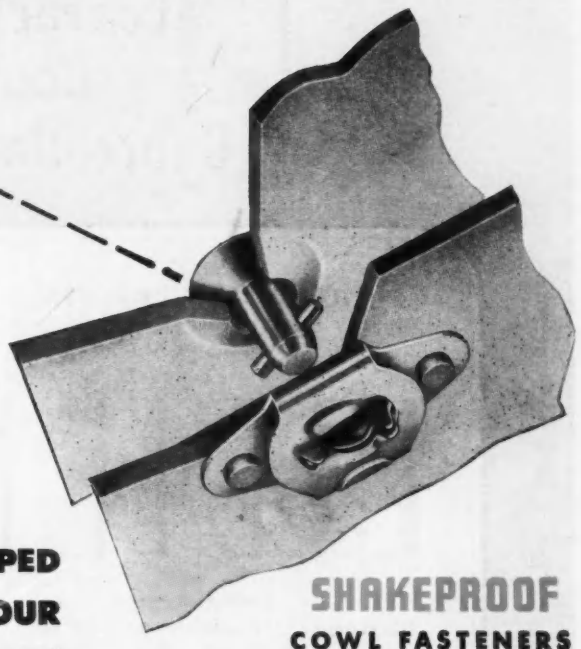
FOR EXTRA SALES APPEAL!



THIS QUICK-OPENING FASTENER, DEVELOPED FOR AIRCRAFT, CAN BE DESIGNED INTO YOUR PRODUCT BY SHAKEPROOF ENGINEERS!

Add a new sales feature to your product! Shakeproof Cowl Fasteners provide a fast, easy opening and closing of covers, doors and panels that assure extra product utility and complete user satisfaction.

Call in a Shakeproof engineer to study your product. Let him recommend the proper application of this new locking principle. He will also point out its easy assembly features and the most efficient methods of attachment for different types of materials.

Write today—a Shakeproof field engineer will soon contact you!

SHAKEPROOF

COWL FASTENERS
Only 3 parts—spring unit, stud and cross pin.

Spring action design provides extra-tight closure.

Positive cam-type lock will not loosen under vibration.

Flush, oval and wing type stud heads available to meet individual product requirements.

ARMY E NAVY

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"fastening Headquarters"

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Shakeproof Type 1 Thread-Cutting Screw for Metals

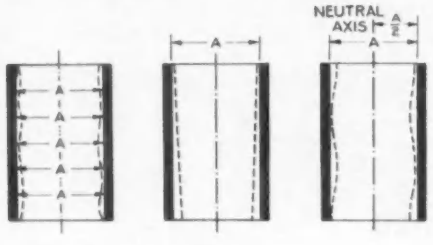
Shakeproof Type 25 Thread-Cutting Screw for Plastics

Sems Fastener Units Pre-Assembled Shakeproof Lock Washer and Screw

MICROMATIC offers you
THE HYDROHONER

Accuracy, Uniform Size
Stock Removal
Controlled Surface Finish

THE HONING PROCESS



Diametric Roundness	GENERATES Diametric Straightness	Axial Straightness
	CORRECTS Taper	
Out-of-roundness		Axial Distortion

Micromatic Hydrohoner—
With Automatic Microdial . . .
Precision Hones to uniform size.
Machine stops when correct size is reached.

Micromatic Honing is a process for finish machining cylindrical surfaces — internal or external by means of controlled abrasion.

Abrasive sticks positively expanded by the hone, are rotated in contact with the work and are given one or more reciprocating motions at the same time—all actuated under extremely low speeds and pressures.

Stock is removed at rates up to .001" per minute on diameter—to more than 1 cubic inch per minute in volume on hard, forged steel.

Roundness is generated—out-of-roundness is corrected within tolerances as low as .0001" in many applications. Taper is corrected and diametric and axial straightness is generated by strokes long enough to overcome deformity.

Uniform size is generated in high production to tolerances as low as .0005".

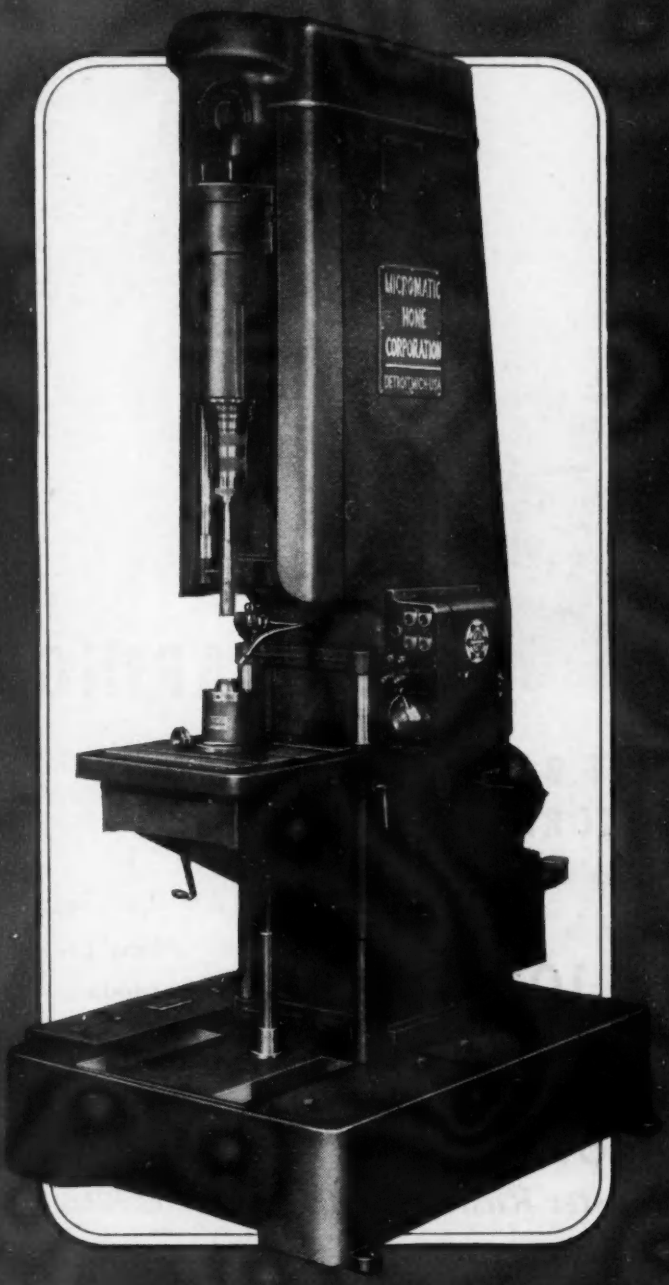
Microhoned surface finish may be controlled to any degree — from matte (grey) to mirror (black).

MICRO MATIC

Micromatic
HONE CORPORATION
Detroit 4, Michigan

MAKERS OF HONING MACHINE TOOLS

a New VERTICAL HYDROHONER



A High Production Vertical Type Hydrohoner

Stroke . . . 0 to 1"

Centralized Hydraulic Operating Control Panel provides easy operation—fast production. Hydraulic tool expansion assures uniform pressure and cutting rates for fast precision work.

Other features are—hydraulic timer—full ventilated hydraulic oil tank of 60-gallon capacity mounted in base.

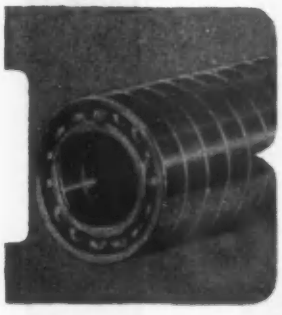
Also available with 3-speed transmission, rising screw table, electric timer, special coolant filter, and special coolant refrigeration.

Available for normal prompt delivery.

Micromatic HONE CORPORATION

DETROIT 4, MICHIGAN

Like a mirror



ALL BEARINGS MUST BE KEPT *Bright and Shiny*

PROTECT BALL BEARINGS FROM CORROSION WITH

NOX-RUST
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NOX-RUST
No. 402-C
The Master Rust Preventive

Ball bearings stored domestically or shipped overseas need protection against corrosion. These two NOX-RUST products have been developed for this specific purpose . . . NOX-RUST No. 102-BC for hot-dip rust prevention and No. 402-C for those preferring an oil-type rust preventive. Both are highly resistant to oxidation and furnish maximum protection in atmospheres of high humidity at high temperatures.

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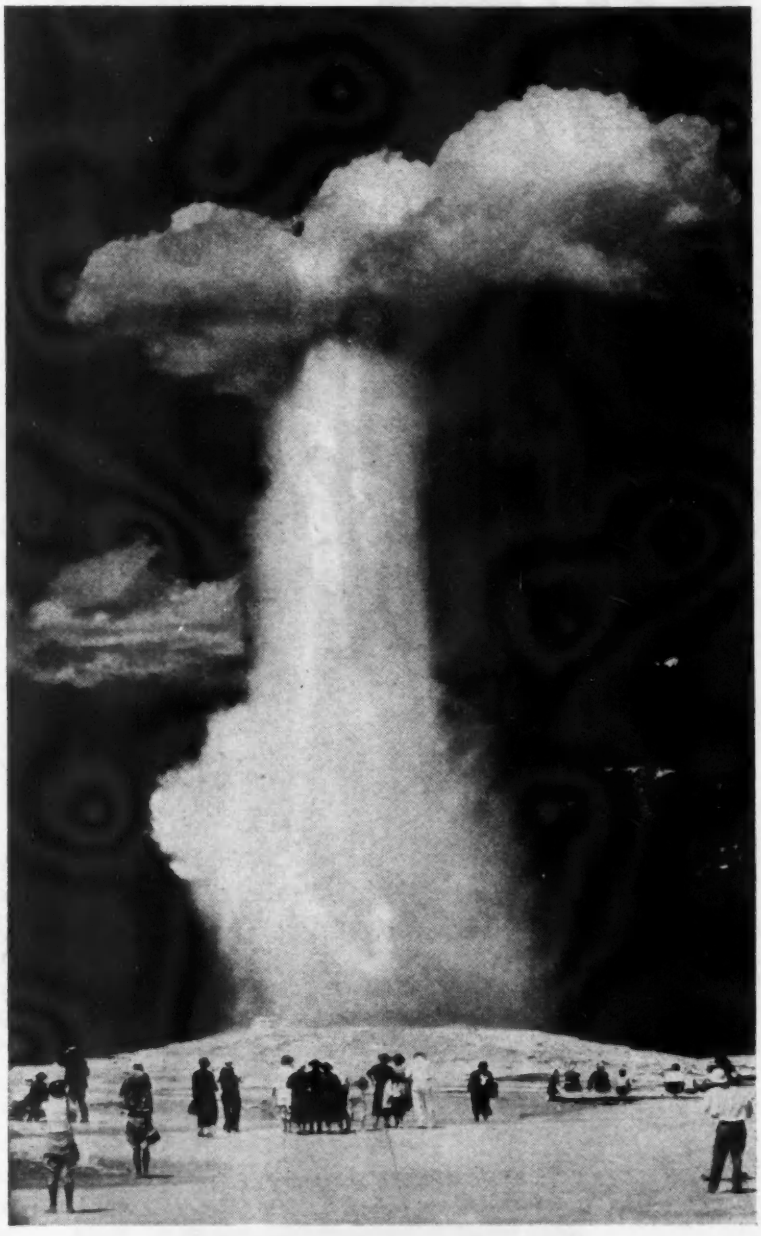
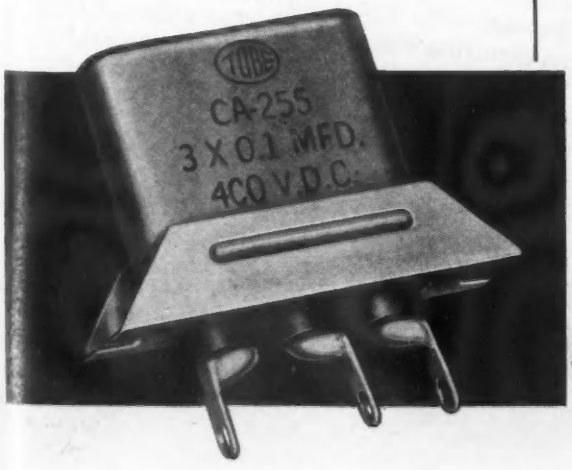
OLD FAITHFUL GEYSER, Yellowstone National Park. Geologists believe it began erupting before the last glaciation, about a million years ago. Within record, Old Faithful has erupted continuously at about 65-minute intervals, spouting a column of water 95—130 feet high for 4½ minutes.



STILL GOING STRONG

LONG, UNINTERRUPTED service under all operating conditions is the characteristic you want most in a capacitor. Tobe Capacitors serve so well and so long because every step in their manufacture is checked and cross-checked by rigid inspections. Constant improvement through constant research is the promise performed by Tobe engineers. An example is the Tobe CA-255 Capacitor, shown below, now available in a new drawn container of improved construction. Why not call on Tobe for prompt, specialized help on your capacitor problems?



SPECIFICATIONS—CA-255

Mineral Oil Impregnated and Filled. Aluminum Foil. Highest Grade Kraft Tissue.

CAPACITY RATING..... 3 x .1 mfd.
VOLTAGE (working).....400 V. D. C.

DIMENSIONS: 1 11/16" wide: 9/16" deep: 2 7/16" long, including channel mounting bracket. Mounting centers 2⅛". Three terminals ½" on centers. Height of terminal ¾". Diameter of mounting holes, .144.

FEATURES: Rugged Channel Mounting Bracket securely soldered to container . . . Increased terminal insulation . . . Rigid terminal lugs afford ample space to handle No. 14 stranded wire . . . Improved streamlined drawn container instead of fabricated can . . . Type, capacity and voltage die-stamped on container. Meets U. S. Army Signal Corps Specifications 71-516-E.

Other values and voltages may be obtained in above mentioned container construction. Send for details of our "OM" and "OD" Capacitors.

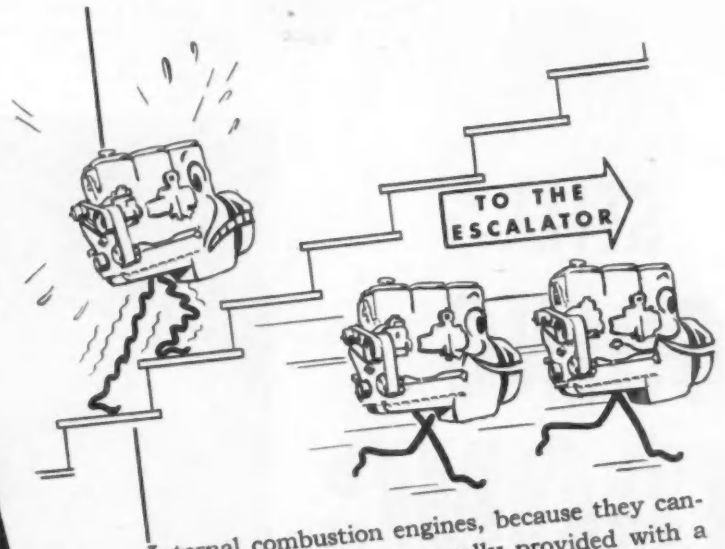
TOBE DEUTSCHMANN CORP. TOBE CANTON · MASSACHUSETTS

A small part in Victory today...

A BIG PART IN INDUSTRY TOMORROW!

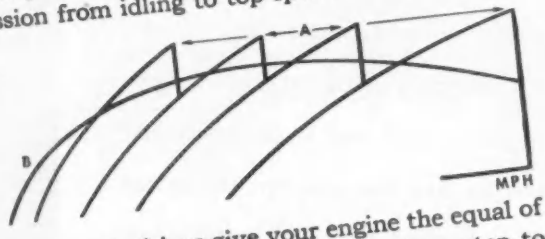
Why make your engine use steps?

Top Illustration—Hydraulic Power Take-off
Bottom Illustration—Hydraulic Torque Converter



Internal combustion engines, because they cannot start in high, are usually provided with a series of steps or gears so that the driven load can be applied gradually as the engine gains speed.

At each step, the engine must be slowed down slightly to permit shifting of gears. Thus, progression from idling to top speed looks like this:



Hydraulic drives give your engine the equal of an "escalator" . . . no slow down from step to step. The result is a smooth, steady acceleration with no jerks . . . no shock loads . . . either on the engine or the driven unit.

Both the Twin Disc Hydraulic Coupling and the *Hydraulic Torque Converter provide this cushion for smooth, shockless acceleration. But only the Twin Disc Hydraulic Torque Converter gives you the added advantage of torque multiplication, amounting to five times the input torque when the output shaft is stalled.

We have accumulated a fund of field data on the use of both types of hydraulic drives. Our engineers would be glad to place this at your disposal while you're planning new products or modernizing the old ones. TWIN DISC CLUTCH Co., Racine, Wisconsin, (Hydraulic Division, Rockford, Illinois).

*Lysholm-Smith type.

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Boeing's New Wind Tunnel 18

Every once in a while there appears a new "bigger and better." This time attention is centered on the Boeing Aircraft Co. at Seattle where they have just dedicated a new laboratory and wind tunnel that is worth knowing about. It has a number of "never before" features.

Bending Time Reduced By Induction Heating 20

Engineers at the Douglas plant have gone into a most exhaustive study of uniform heating by induction. This report of their research. It is complete in text and illustrations.

Contour Forming of Extrusions by Stretching 22

Here is technique that has been receiving more and more attention. What they are doing and what they are accomplishing at the Lockheed plant is told here in pictures and text. It is authoritative and was written by the "man behind the gun."

Studebaker 2½-Ton Military Trucks 26

A big job well done, and how, is the subject matter of this account of one of the country's outstanding records in the war program. Illustrations liberally augment the detailed text.

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Here is a description of an experimental plane that might well have a great deal of bearing on the designs of tomorrow.

Fabrication of Large Sections 34

The C-46 airframe structure is made up of 25 elements. They are brought together on an S-shaped final assembly line that has a number of features that are "off the beaten path." You will find reading about them interesting and profitable.

Procurement and Manufacturing Time Cycle 42

How long it takes to get, process and assemble "this and that" in the production of the army aircraft is shown in a most comprehensible way.

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.

Big Government

By Eric Johnston*

A LITTLE band of Pilgrims on a New England beachhead laid the foundation for a mighty country. Generation after generation, other beachheads were taken and held against heavy odds.

Today, we are on the eve of the greatest fight for a beachhead in history—a beachhead which our young men will forge then expand until the last threats to our free institutions *from without* have been utterly destroyed. To us at home is given the solemn duty of holding our beachheads here. They too must be enlarged and expanded until the last vestige of threat to our free institutions *from within* has been destroyed.

At war's end, we shall have to dismantle the machinery of war production and redirect our economic energies to the uses of peace. At the same time—and this is more important—we shall have to dismantle the machinery of war government. Military victory and industrial stability will have little meaning if in the process of obtaining them we maneuver ourselves into permanent subjection to big government.

As a people, we Americans do not frighten easily. But in the decade before the war we were fed a heavy diet of fear—fear of personal insecurity, fear of another depression, fear of business, fear even of ourselves. The defeatists and pessimists got us so concerned fearing other things we forgot the fear that really is important—the fear of big government.

To keep our thinking clear, we must recognize that something entirely new has been added to our economic structure. Formerly, we had three primary economic estates: management, labor and agriculture. Now, we have a fourth—huge, sprawling, power-hungry—throwing ever new tentacles around the other three. It is government. It has flourished into a vested interest. Measured in power, it already is our dominant estate. It feels the urge of growth, expansion, perpetuation.

When wartime controls can be lifted, will individual rights be fully restored? Will the pendulum that has moved so far in the direction of government domination be allowed to swing back freely from authority to liberty? This question touches the core of American destiny. We dare not ignore it.

We need effective government, of course. But government must be limited in its scope, under constant and vigilant popular control.

* From an address before the American Newspaper Publishers Association.

Intricate Shapes Quickly Cut by Flame

Short Cuts and Economies Developed . . . Time Saved

Many manufacturers are revolutionizing their products, saving time and effecting many economies by using strong rolled steel, flame-cut to exact size and shape. No matter how intricate, Ryerson flame-cutting equipment produces neat accurate work—and hundreds or thousands of identical pieces are turned out quickly.

Whenever you need flame-cutting service, call Ryerson. You'll get immediate action—prompt delivery. If there is any question, we will review your specifications or estimate any job you have at hand. Get in touch with the nearest Ryerson plant.

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RYERSON

AUTOMOTIVE and AVIATION INDUSTRIES

Published on the 1st and 15th of the month

Vol. 90, No. 10
May 15, 1944

What is Full Employment?

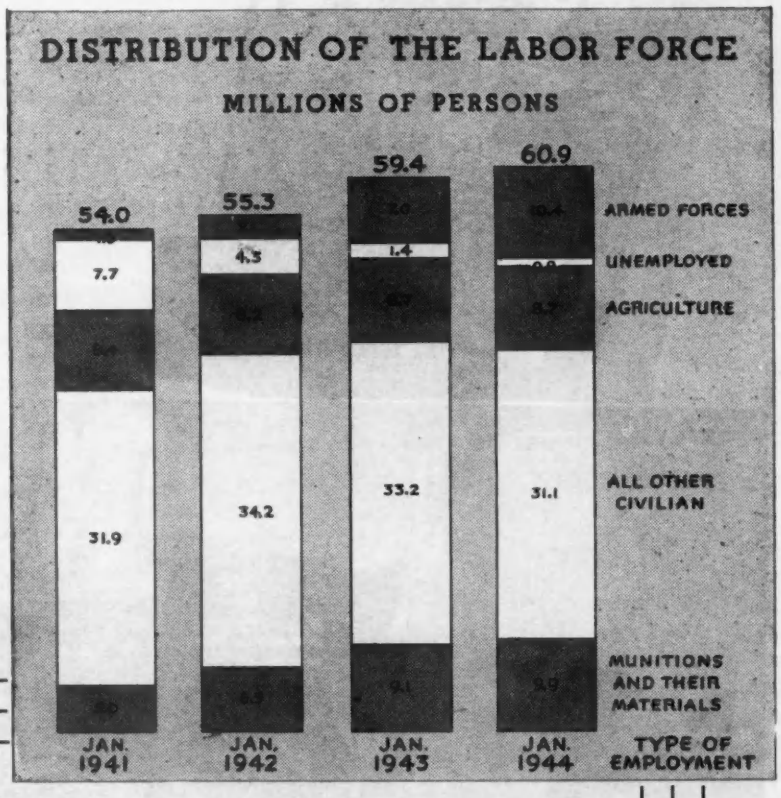
by Frank Rising

General Manager,
Automotive & Aviation Parts
Manufacturers, Inc.

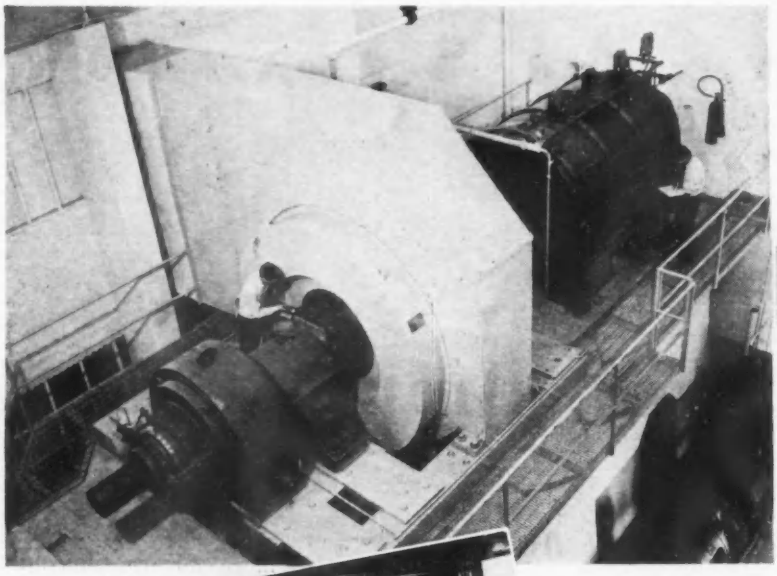
A MAJOR problem of postwar employment will be that of getting the country educated to the realization that we are starting with the wrong assumption by maintaining that we have to keep more than 60 million persons at work. It isn't necessary and it isn't sound. It is an error to assume that once an individual has held any kind of paid job, he is "unemployed" thereafter when he is not working. We have a tendency to put all job seekers in a single category. The war emergency has seen the hiring of several million temporary employes from the ranks of housewives, students, minors and older persons who had retired. When these temporary employes are released from their wartime jobs, they should not be classified as "unemployed" in the sense that family breadwinners were so classed in the depression thirties. This is a false approach to the employment problem.

In the postwar period, efforts should be directed towards the encouragement of many of these persons holding temporary jobs to seek an outlet for their energy and talents in education, the arts, science, recreation or charitable endeavors. These fields would utilize the abilities of many persons who otherwise would be competitive job seekers. Many young people now working in factories, attracted there by patriotic motives, high wages or curiosity, should be encouraged to get out and seek more education and ability. Other pursuits should attract teachers, professional men, lawyers, farmers, salesmen, nurses and architects, who have been drawn to munitions plants by swollen wartime wages and whose peacetime activities have been reduced or eliminated by the war. These persons should not be considered as normal candidates for factory jobs.

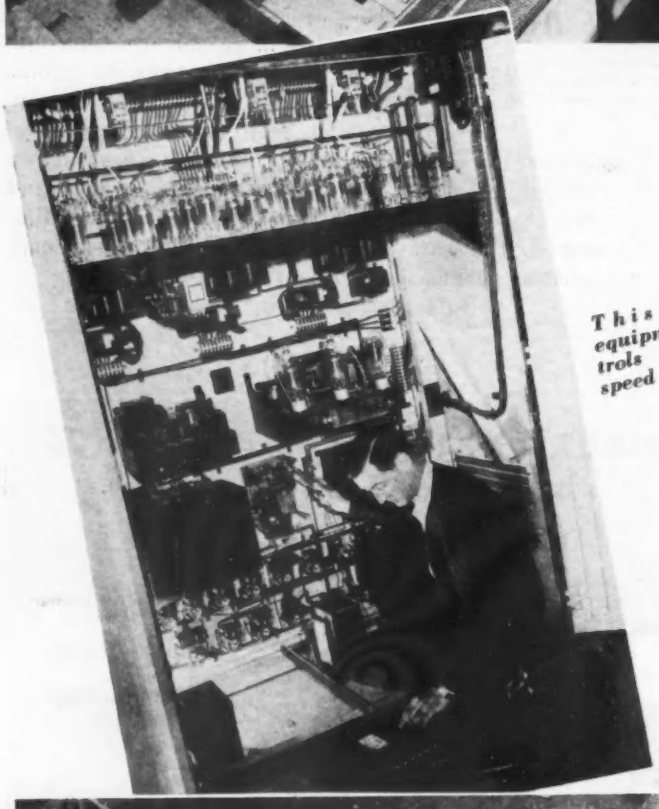
(*Turn to page* 90, *please*)



Despite the fact that the labor force represented as a percentage of total population 10 years of age and older has dropped from 53.3 per cent during 1909 to 48.9 in 1942, this percentage has remained fairly constant since the beginning of the century, according to the records of the Conference Board. During 1917 and 1918, when World War I production was in full swing it stood at 51.2 and 50.8 per cent respectively and in 1929, the peak year of civilian production, it dropped to 49.6 per cent.



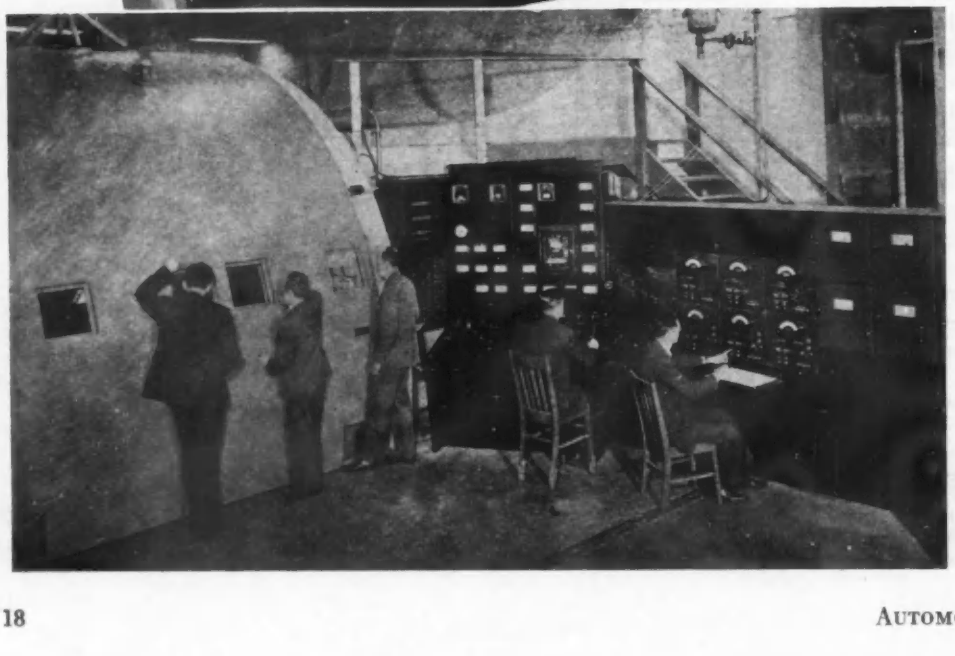
Power to drive the 24-ft. diam fan is supplied by the Westinghouse 18,000 hp electric motor (foreground) encased in the light-colored hood. In front of it is the 400 hp Westinghouse starting motor. At the rear is the Dynamatic magnetic clutch.



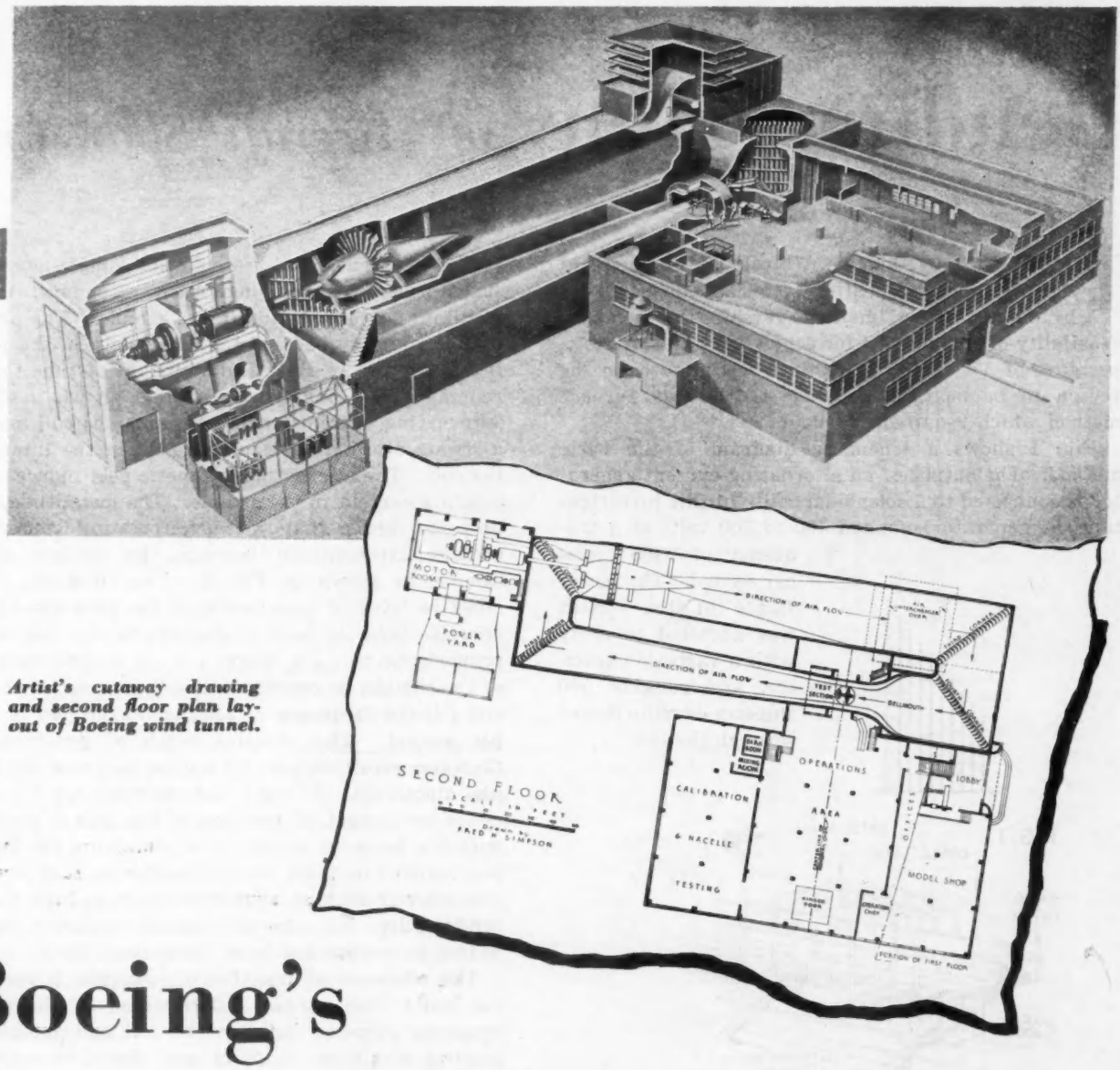
This electronic equipment controls the fan speed during tests.

NAMED the Edmund T. Allen Memorial Aeronautical Laboratories in honor of the famed Boeing test pilot and scientist who lost his life last year in an airplane test accident, the new wind tunnel recently placed in operation at Seattle, Wash., by the Boeing Aircraft Co. is a modern research unit with many features which mark it as a distinct step in the progress of the aviation industry. Fastest of wind tunnels in the country with test sections more than 2 ft. in diameter, the new Boeing experimental laboratory can produce wind velocities in the 700 mph range through its 12 ft. wide test section. The new tunnel is a self-contained research unit, complete with model design, construction facilities and computing laboratories, as well as actual testing quarters. Dedicatory ceremonies on April 22 were highlighted by the posthumous award of the prized Guggenheim Medal for 1943 to Mr. Allen. The presentation was made to Mr. Allen's widow, Mrs. Florence Allen, by Philip G. Johnson, president of Boeing, on behalf of the Daniel Guggenheim Medal Board of Award.

Flow of air is created by a 24-ft diameter fan of 16 laminated spruce blades which were designed and built by Boeing engineers. It is mounted on the end of a 37-ft solid steel drive-



Instruments and controls outside the test section.



Artist's cutaway drawing and second floor plan layout of Boeing wind tunnel.

Boeing's New Wind Tunnel

shaft, 16 in. in diameter, which connects the fan with the motor and clutch. The synchronous electric motor, built by Westinghouse, has a rating of 18,000 hp and operates at a constant speed of 514 rpm. The speed of the fan is regulated by a magnetic coupling or "clutch," several times larger than any previously built, which is installed between the motor and the fan. This coupling was built by the Dynamatic Corp. The tunnel was built by the Austin Co. to Boeing specifications. The extreme accuracy of concrete work in the walls of the tunnel's test section, where very close tolerances were maintained, is a noteworthy achievement.

An intricate Boeing-designed system of balances, capable of measuring with accuracy lifts from 0.10 lb up to 8000 lb, records all the forces acting on the model being tested. An ingenious automatic printer, which is part of instruments and dials on the main control board outside the test section, will, at the touch of a button, record and print on a tape all the forces acting on the model at that instant.

The tunnel bore is a complete, continuous-return structure which follows an approximately rectangular course 450 ft in length. It varies in size from eight ft by 12 ft in the test section to 27½ ft by 27½ ft at the largest part. When operated at high speed, the air completes the 450-ft circuit in less than two seconds. Inasmuch as 11 per cent of the air in the wind tunnel is expelled and replaced with fresh air at every "round trip" for cooling purposes, under high speed operation the air in the tunnel is completely replaced with fresh air three times per minute. A pagoda-like structure, known as an interchanger tower, is located

(*Turn to page* 114, *please*)

Bending Time *of Aircraft Spar Caps*

INVESTIGATION by Douglas Aircraft Co. engineers of the possibility of heating spar cap billets quickly by an induction method reveals the complete feasibility of this method for achieving a uniform temperature of 350 to 400 F within a few minutes in the region to be bent, in contrast to the gas furnace method which required two hours.

Fig. 1 shows a schematic diagram of the basic method. The output of an alternating current generator is connected to a solenoidal coil. In this investigation the generator supplied 400 to 500 volts at a frequency of 9600 cycles per second. The power factor of the circuit was adjusted to unity with a variable capacitor, and roughly 500 amperes or more flowed through the coil.

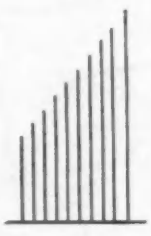
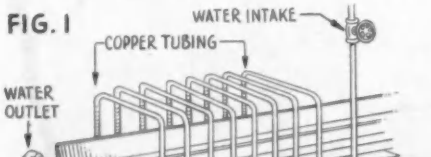


FIG. 1



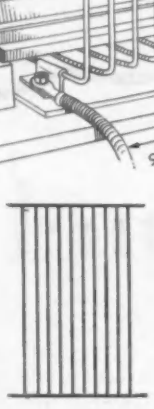
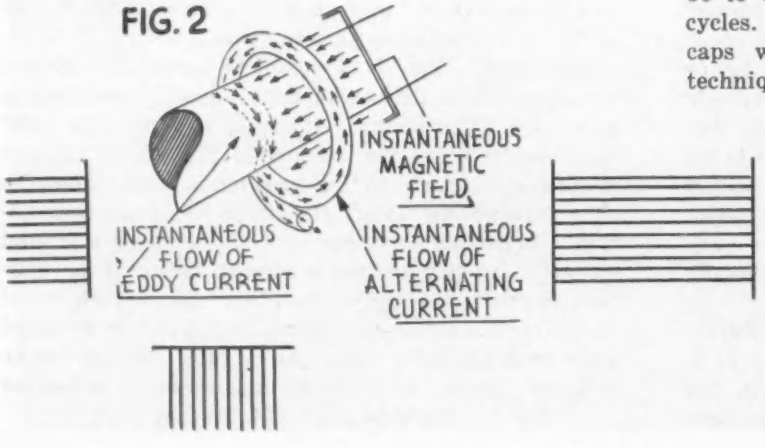


FIG. 2



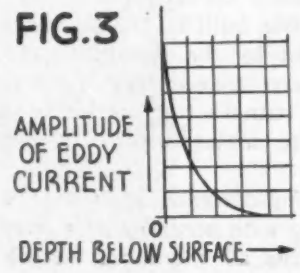
The combination of the coil and sample acts like a transformer with a single-turn secondary, with a resultant current step-up in the sample. The physical mechanism may be represented crudely in the following fashion: At a particular instant of time the current and field configuration is that shown in Fig. 2. Alternating current flowing through the coil produces a strong alternating magnetic field in the interior of the coil. The alternating magnetic field induces a circulating current in the sample. The magnitude of the field and hence that of the circulating current decreases exponentially beneath the surface of the sample, as shown in Fig. 3. The thickness of the effective layer of penetration of the field (and of the effective layer of heat production by the current) is proportional to $\sqrt{\rho/f}$, where ρ is the volume resistivity of the sample, or resistance of a 1 cm cube in ohm-cm, and f is the frequency of alternating current in cycles per second. The effective depth of penetration is therefore relatively low for a good electrical conductor like aluminum. In steel, for example, for $f = 9600$ cycles per second, 85 per cent of the heat is generated within a layer ½ in. thick; in aluminum the layer is less than 0.1 in. thick. Since metal with high electrical conductivity such as aluminum has also high thermal conductivity, the core of a good conductor may be heated by conduction from the surface alone.

The efficiency of transfer of electrical power from the coil to the sample is determined by the electromagnetic coupling between the coil and sample. In general maximum coupling and therefore maximum transfer of energy occurs when the coil is geometrically close to the object being heated.

Equipment and Tests

A standard 60 KW Tocco Jr. induction heater, type 60 MG 10B, manufactured by the Ohio Crankshaft Co., was used for the investigation. The machine consists essentially of a motor-generator combination to convert the line current, 440 or 550 volts, 3-phase AC, 50 to 60 cycles, to 440 volts, single-phase AC, 9600 cycles. Temperatures at various places within the spar caps were measured by conventional thermocouple technique, using copper-constantan couples.

FIG. 3



Reduced *by* Induction Heating

By E. H. Plesset

Electrical Research Engineer
Douglas Research Laboratories

and J. R. Chadwick

Methods and Materials Section,
Engineering Dept., Douglas
Aircraft Co.

Two sample billets were selected as representative: (1) Type A, heavy section, is shown in Fig. 4. This billet had nearly the largest mass of any in use at the time of the investigation, so it was felt that if it was practicable to heat this billet no difficulty should be encountered from the power standpoint in heating any other type spar cap.

(2) Type B, light section with a web, is shown in Fig. 5. Since this billet had a relatively long and thin web, some trouble in maintaining a low thermal gradient between the outer end of the web and the body of the section was anticipated.

Results and Discussion

The heating of the Type A spar cap presented no technical difficulties beyond the provision of sufficient power to heat such a large mass of aluminum. Fig. 4 shows the heating curve for a 24-inch long section of this type billet. The time of heating could be decreased by the application of a larger amount of power or by the use of a coil in which the turns were closer to the cap, for example, a coil with a rectangular cross section.

A heating and cooling curve for the Type B spar cap, which was selected as representative of those to be encountered in future production, is shown in Fig. 5. The high temperature gradient is not surprising. Since at the frequency used, 9600 cycles sec, the depth of penetration of electromagnetic energy in aluminum is essentially less than 0.1 inch, the web absorbs, in relation to its mass, a large amount of power and, accordingly, a relatively large amount of heat is generated within the web.

(*Turn to page* 86, *please*)

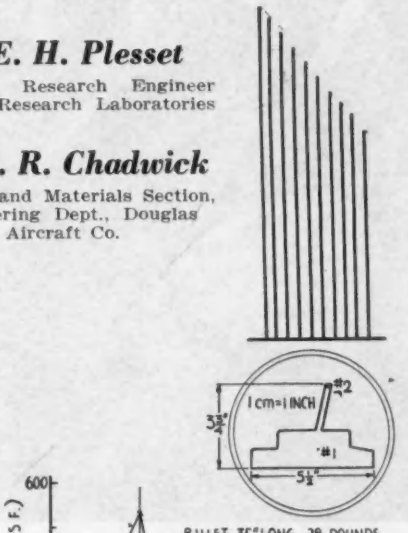


FIG. 5

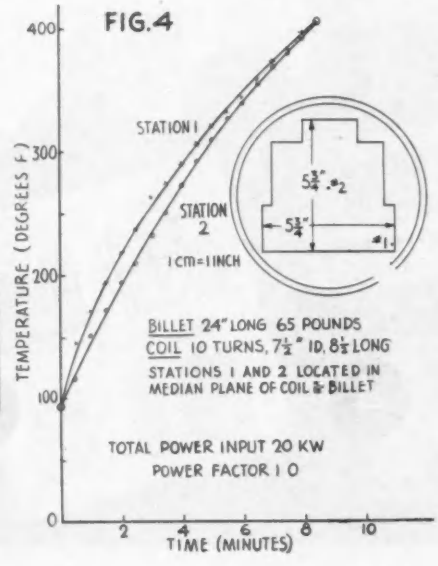

STATION 1
STATION 2
1 cm=1 INCH
BILLET 24" LONG 65 POUNDS
COIL 10 TURNS, 7½" ID, 8½ LONG
STATIONS 1 AND 2 LOCATED IN MEDIAN PLANE OF COIL & BILLET
TOTAL POWER INPUT 20 KW
POWER FACTOR 1.0
TEMPERATURE (DEGREES F.)
TIME (MINUTES)

FIG. 4

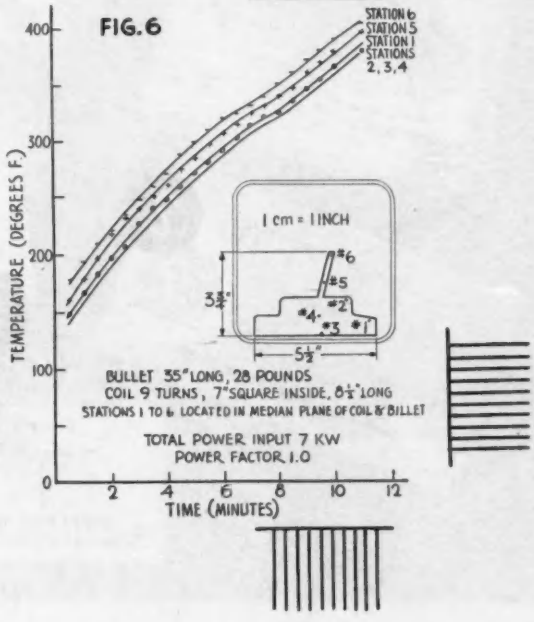


FIG. 6

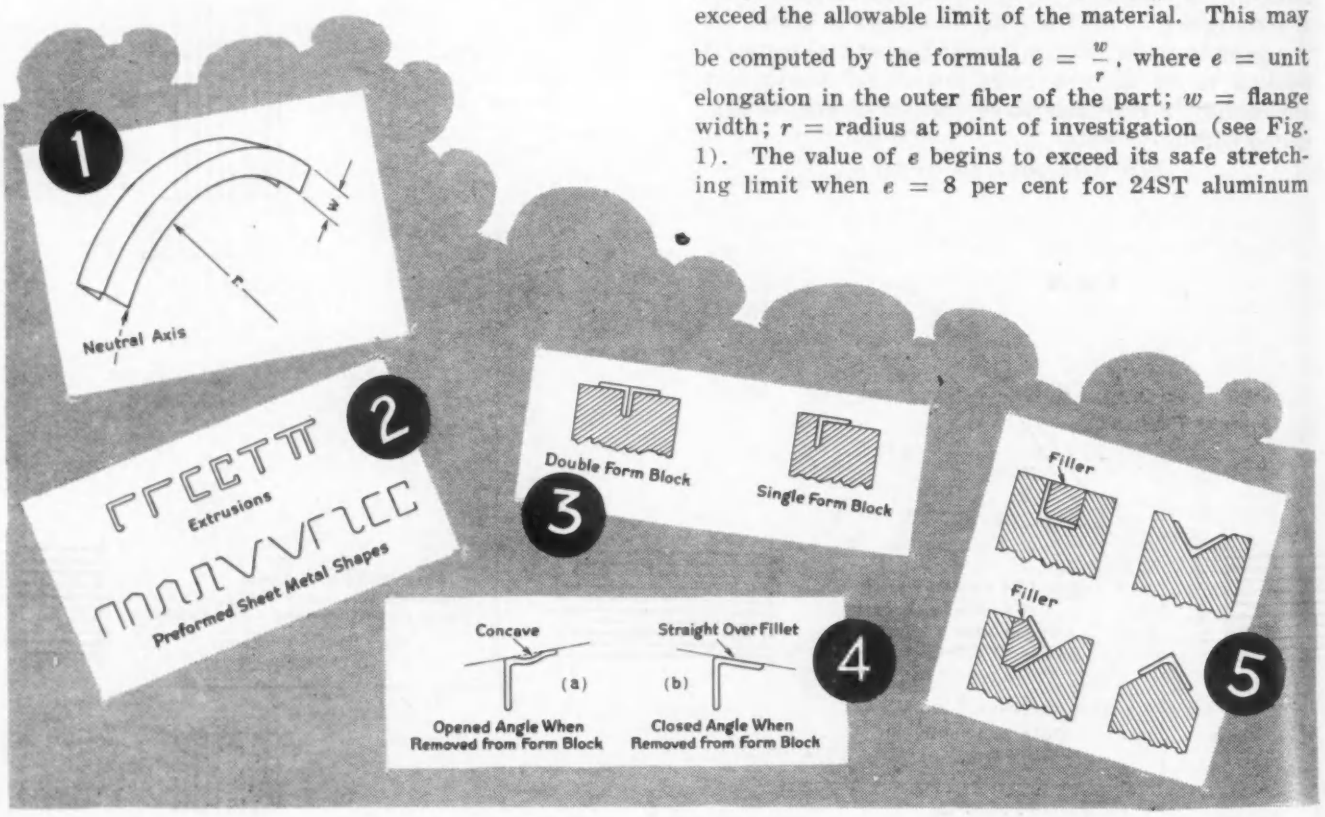
Contour F

By
Jack
Johnson,
Production Design Engineer,*
Factory B,
Lockheed Aircraft Corp.

Leading edge with scribed circles showing elongation.

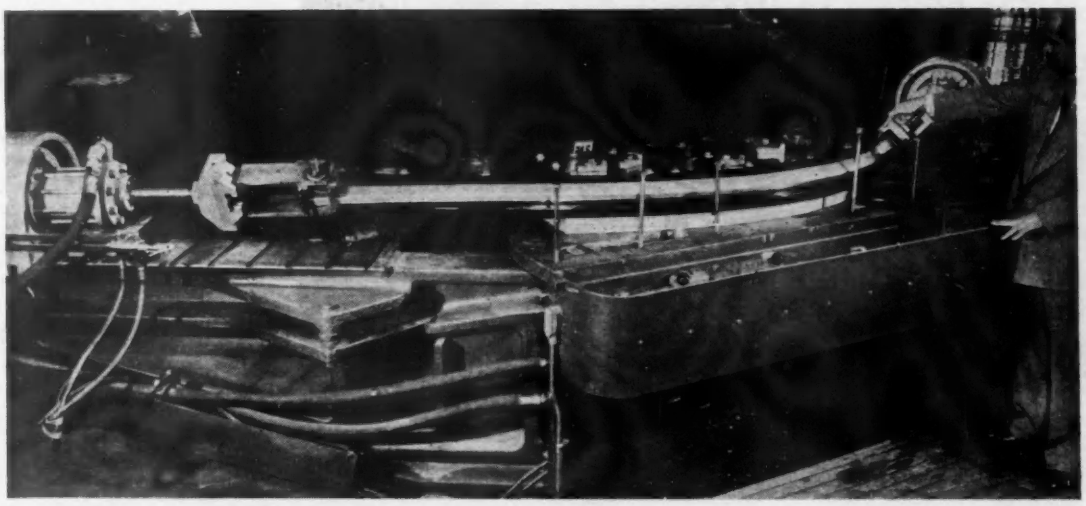
THE stretch forming of airplane parts to contour is a forming method which, while greatly simplifying the making of parts often difficult to form by other methods, entails relatively little tooling cost. Practically all metals may be stretch formed to contour, among them being 24SO, 24ST, 61SW aluminum alloys, as well as 302A and 302-¼H stainless steels.

In most cases the form block need not be developed for springback, but can be made to loft contour as called for by the blueprint, since this forming method places the metal in the plastic range. Great care must be exercised, however, not to exceed its ultimate strength. All parts should be checked for stretch limits within their own curvature to insure that the elongation in the outer fibers of the part does not exceed the allowable limit of the material. This may be computed by the formula $e = \frac{w}{r}$, where e = unit elongation in the outer fiber of the part; w = flange width; r = radius at point of investigation (see Fig. 1). The value of e begins to exceed its safe stretching limit when e = 8 per cent for 24ST aluminum



Forming of Extrusions

and Preformed Sections by Stretching

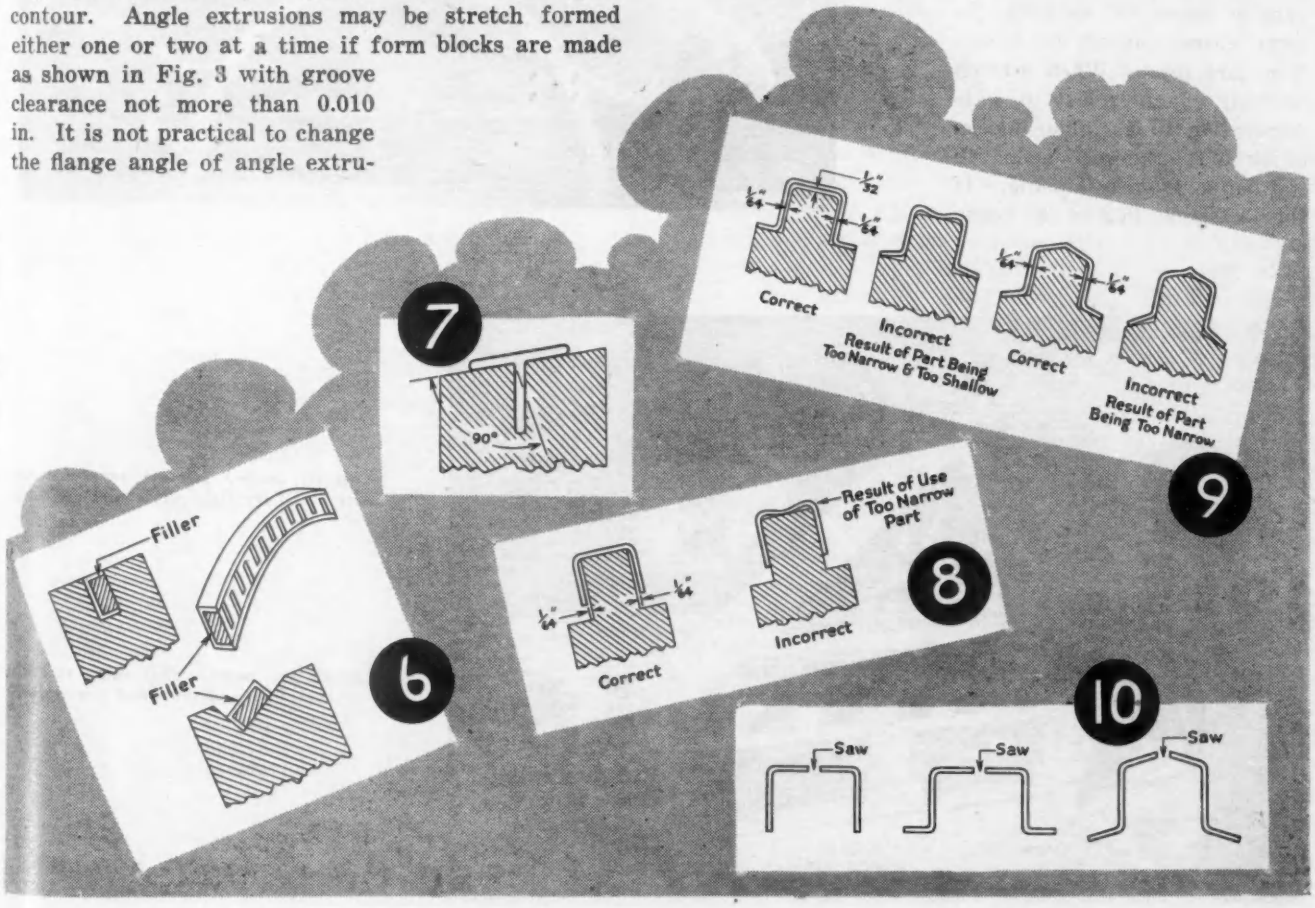


Angular contouring of preformed angle on Hufford machine.

alloy and $e = 14$ per cent for 61SW aluminum alloy and for 302-¼H stainless steel.

Forming Extrusions

Extrusions as well as preformed sheet metal shapes, Fig. 2, are admirably adapted to stretch forming to contour. Angle extrusions may be stretch formed either one or two at a time if form blocks are made as shown in Fig. 3 with groove clearance not more than 0.010 in. It is not practical to change the flange angle of angle extrusions when stretching to contour, for the flanges become concave, as shown in Fig. 4(a), due to excess metal in the fillet. The heel itself cannot be changed, as bending occurs at the point of tangency of the fillet, causing either a high or low spot, depending upon



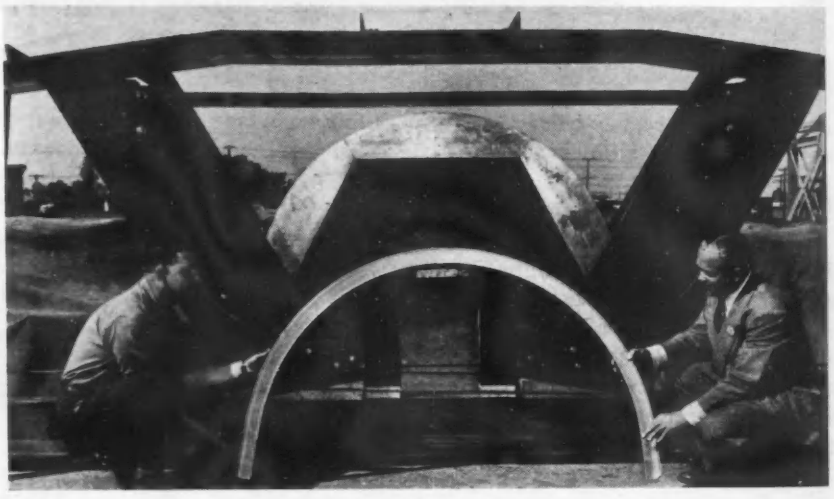
of contour, the channel must also be recessed within the form block with a clearance of not more than 0.015 in. The flange angle of a "T" extrusion may be changed while stretch forming, the form block being made as shown in Fig. 7. Cutting the block at 90 deg to the flange angle to a depth just a little greater than the radius of the fillet will allow the flange to bend as shown, instead of becoming concave.

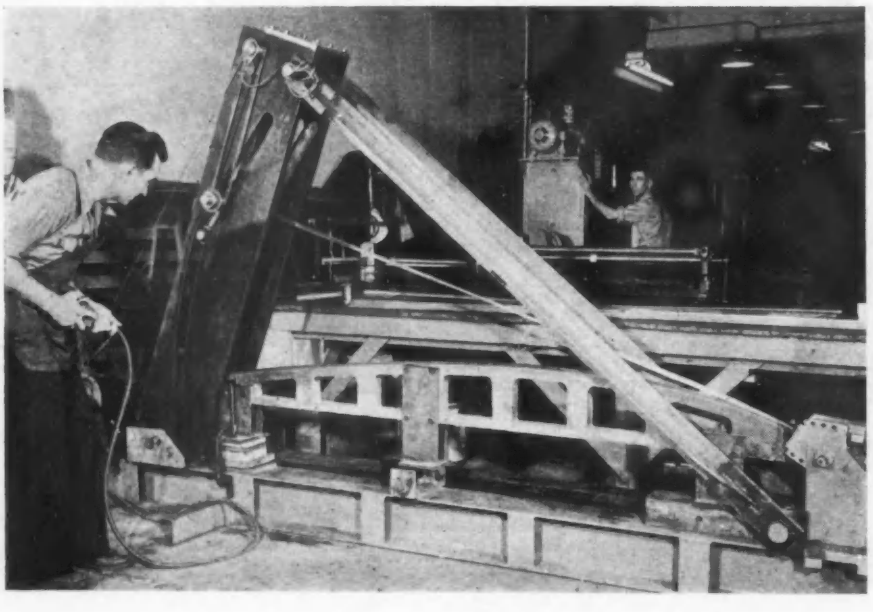
Forming Sheet Metal Sections

The success of stretch forming sheet metal preformed sections depends greatly upon the consistent accuracy of preforming the part to its cross sectional shape. The use of the hydro-press to preform the

whether the flange is opened or closed. When possible, all angular changes should be made by decreasing the angle rather than opening it, Fig. 4(b).

The extrusion may lie in various positions, as shown in Fig. 5, using filler blocks when necessary. These fillers are usually made of micarta; in some cases jointed wood sections are used. When stretch forming channels, Fig. 6, it is imperative to use filler blocks of close tolerance to keep the top flange from collapsing. If the web is 90 deg to the plane

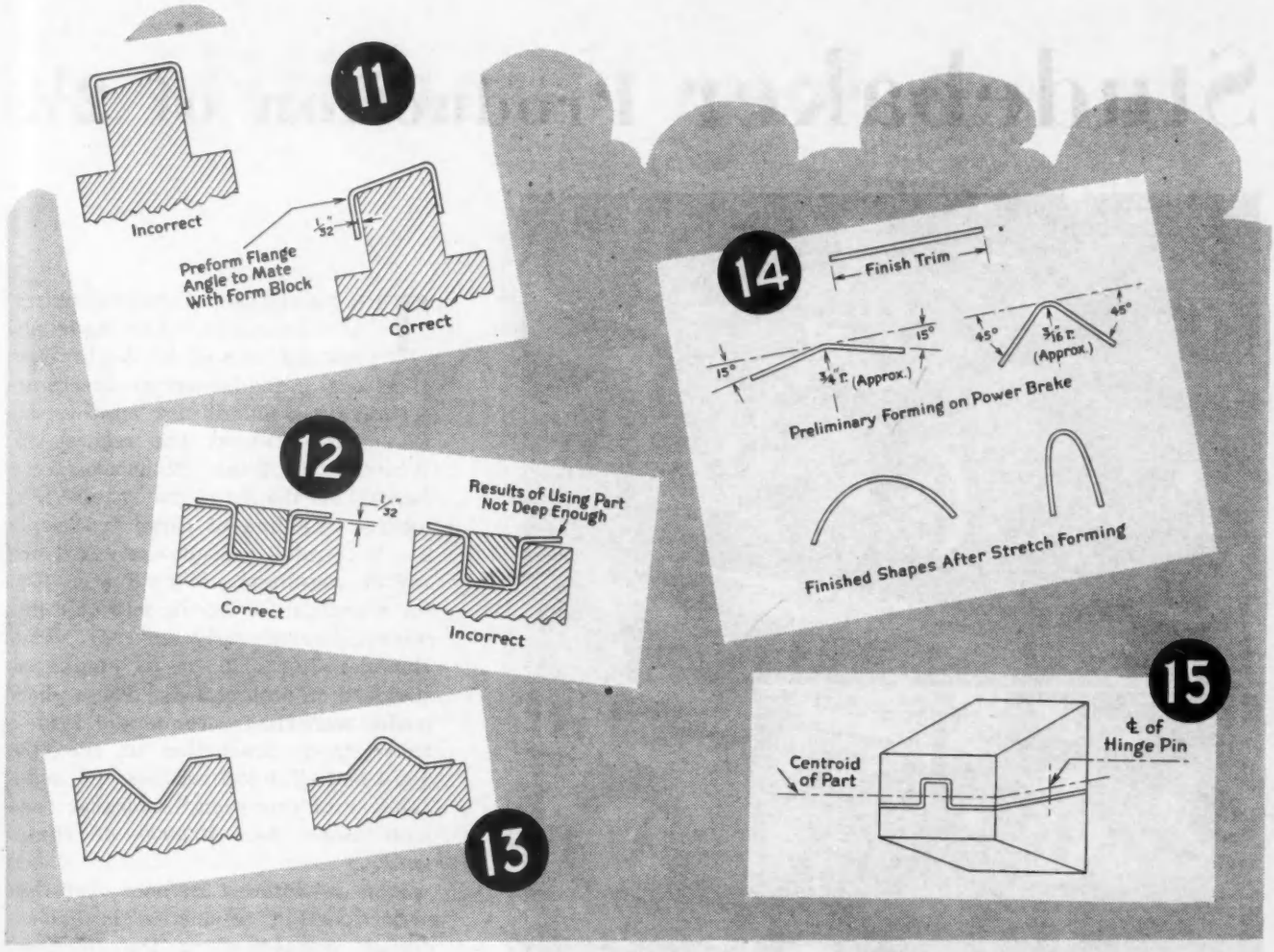




(Top of page) Bissell stretch machine P-38 leading edge corrugation.

(Center of page) 180 deg. stretch machine. Formed channel extrusion.

(Bottom of page) Track stretch machine in operation.

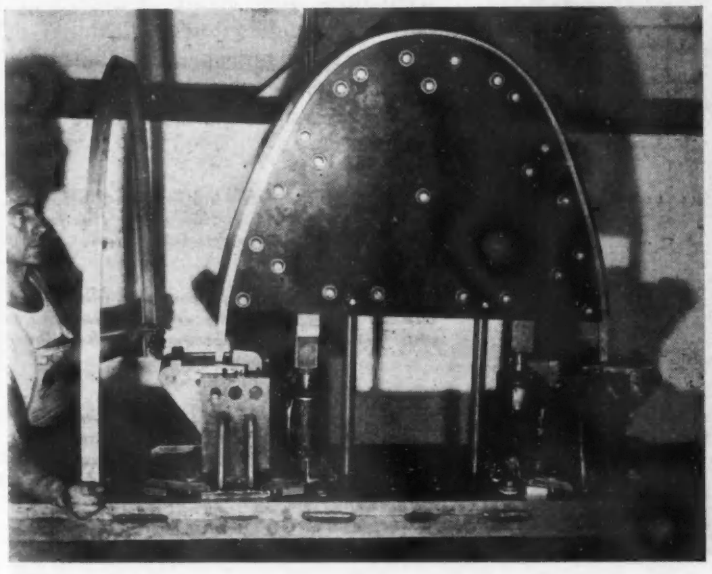


section is recommended. In forming a channel with the flanges down (Fig. 8), it is important to make the developed width 1/32 in. wider than called for on the blueprint to allow for lateral shrinkage resulting from longitudinal stretch. If this extra width is not allowed, the lateral pressure forces the metal at the mold line to move up on the side of the form block, allowing the center web to become concave. The same allowance must be made if the part is a hat section, plus an additional 1/32 in. for the depth of the part. Without this extra clearance the resulting part will look as shown in Fig. 9. No extra allowance for depth is necessary on a hat section with bevel flanges and web.

It is good production practice to form hat sections and channels as illustrated in Fig. 9 and then saw down the center, splitting them in half and making two angles or "Z" sections (Fig. 10). If 24ST aluminum angles are to be made by this method they should be preformed in 24SO and heat-treated before stretching to relieve any internal stress caused by preforming. When the part is then sawed in two pieces it will not bow, provided a circular saw with set in the teeth is used.

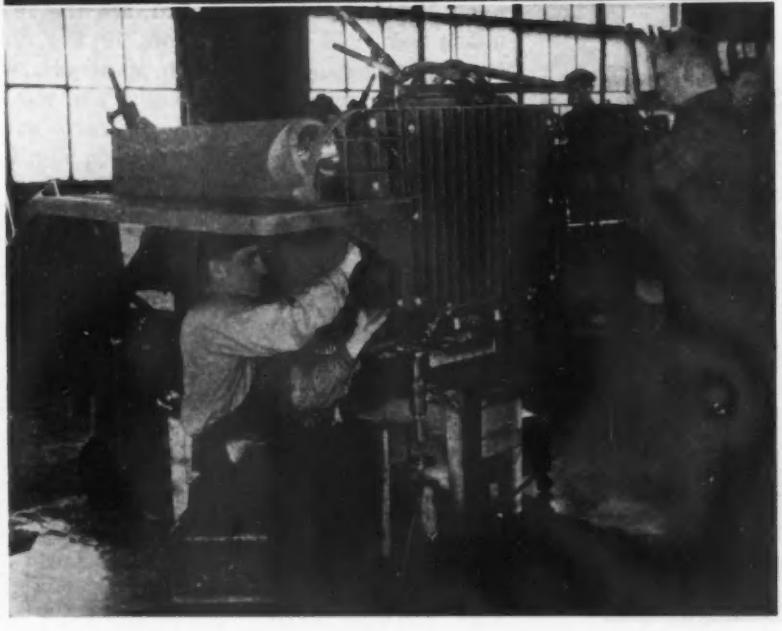
It is not good practice to try to change

(*Turn to page 214, please*)



Stretching channel with variable contour laterally.

Studebaker Production of 2½



THE Studebaker Corp., "Builders of Champions," has made an enviable record in World War II as one of the largest producers of certain types of military vehicles. In December, 1940, at the request of Washington officials, Studebaker embarked on the development of pilot models of a line of cargo trucks of 2½ tons rated capacity—a 6 x 4 on 148 in. wheelbase and a 6 x 6 on 162 in. wheelbase. Pilot models of both were delivered early in 1941. The Hercules JXD 320 cu. in. engine is standard on both chassis. These pilot models were the forerunners of Studebaker truck production of the US 6 x 4 and US 6 x 6 vehicles. By mid-January of this year Studebaker had built more than 100,000 of these trucks.

It is of interest to note that the major part of production is immediately dispatched to the fighting fronts overseas. This poses a problem of export shipping—knocked down—in keeping with the greatest economy of valuable cargo space. Through progressive improvements in procedure and re-design of packing containers, the company succeeded in effecting a reduction in the size of packing crates by 55 per cent. It may be noted that apart from improved techniques, this saving is a corollary of the complete interchangeability of every major component of the truck, making unnecessary the usual procedure of associating components with

(Top Left) Axle bogie installation is made on the chassis line while the frame is in the inverted position.

(Center Left) All fastenings along the chassis line are cold-riveted, using portable pneumatic squeezers made by Cleveland Pneumatic.

(Bottom Left) Typical of sub-assembly operations is this view of the station for making up the front end consisting of radiator, front fenders, side hood panels, etc. As may be seen, the assembly is built up in a massive steel fixture to assure complete interchangeability.

ton Military Trucks

By Joseph Geschelin

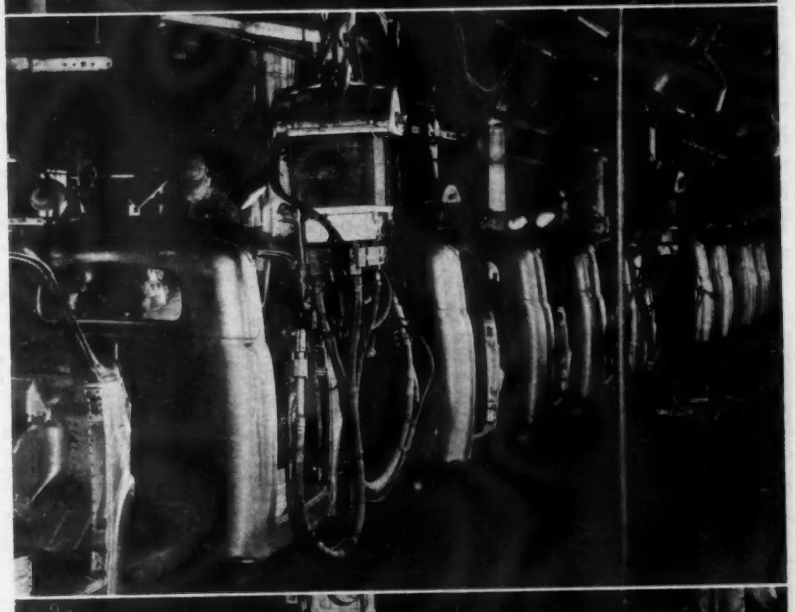
the specific chassis on which they originated.

To support this manufacturing program, the company went into the spare parts packaging business in 1943, setting up a special department for this function. As it operates today, this export department moves more than 900 tons of packaged freight each week.

Being built to Government specifications, the Studebaker military trucks have incorporated in them standard and interchangeable components which are produced by outside suppliers. For example, Hercules supplies engines, Timken supplies axles, Spicer produces the transfer cases, etc. Consequently, the production lines perform essentially assembly functions. Nevertheless, many of the stampings, brackets, and other small parts are manufactured here in the press shop and in the machine shops. Moreover, Studebaker is unique in producing its own leaf springs for all of these vehicles.

Owing to the mass-production character of the operation, it has been feasible to utilize the assembly conveyors, formerly employed in domestic truck production, for the assembly of the trucks. Similarly, cabs are processed through the Studebaker passenger car body department, utilizing the same conveyors, welding facilities, washing equipment, and paint shop.

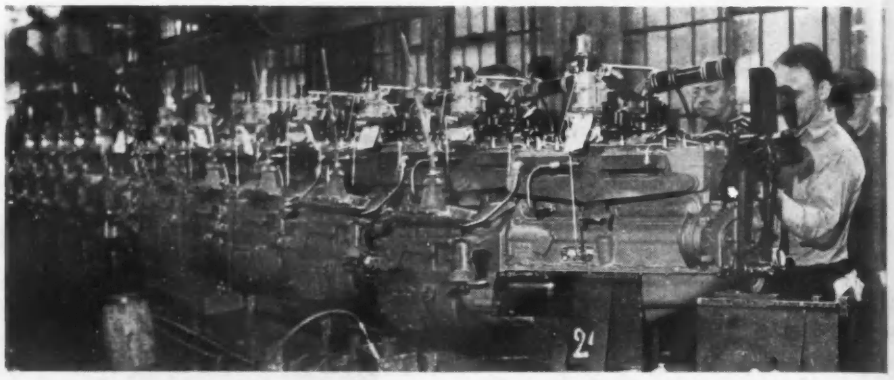
Production begins with frame assembly at the extreme end of the



(Top Right) End of the final assembly line. More than 100,000 of these 6 x 4 and 6 x 6 military vehicles have been built by Studebaker.

(Center Right) Perspective of the body line in the body shop. They use the passenger car conveyor line and even utilize the standard dollies by mounting two cabs on each one.

(Bottom Right) Following Studebaker passenger car practice in the body shop, the major components of the cab are assembled in these massive framing jigs and spot-welded. The portable guns and ceiling-mounted transformers may be seen in the foreground.



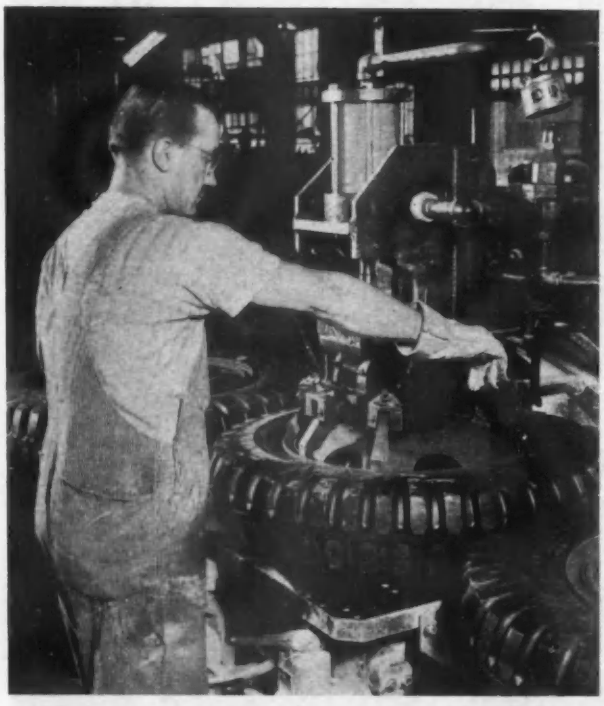
Hercules engines are received in "stripped" condition and are built into complete powerplant assemblies by the integration of clutches, transmissions, carburetors, and accessories.

chassis line. Here are made the attachment of spring hangers and other parts, using Cleveland Pneumatic squeezers for cold riveting of all fastenings. The frames then are placed on the long chassis assembly line which prepares the vehicles for the final assembly line in another building. In keeping with automotive practice, sub-assemblies for both lines are made up on self-contained stations adjacent to the assembly line ready for installation.

One of the major lines in the final assembly department is the motor line. Engines are received from Hercules, tested but stripped of accessories and transmission. The powerplant assembly, ready to run, is completed on a special conveyor line, painted, then transported to the proper station on the final assembly line. Similarly, one of the upper floors has been arranged for the assembly of major sheet metal units such as the front end assembly. Here the front end, including the radiator and shield, and other sheet metal is put together in massive framing fixtures and made ready for installation on the final line.

View in the export packing department showing the protective packing of gears. Operators wrap "no-oxide" paper around the piece to prevent atmospheric attack.

This department also is provided with arc-welding and torch welding booths for various detail fabrication jobs.



An outstanding Studebaker contribution is this tire-mounting press which so simplifies the operation as to make it possible for one man to do the work of five. The machine is automatic in operation. When the operator pulls the lever at the right, four claws—three in front, one in the rear—expand the lock ring with a pressure of 21 tons.

One of the major problems associated with the production of heavy duty vehicles is that of tire mounting. The huge tires required for this purpose do not lend themselves to conventional methods of mounting. At Studebaker, they have developed a unique motorized machine which mounts tires in the twinkling of an eye, greatly speeding the operation, and eliminating an otherwise arduous manual task. The pictorial section shows this remarkable machine in action.

As mentioned earlier, cabs for these trucks are built and painted in the body shop. The large stampings for the assembly are supplied by Edw. G. Budd Mfg. Co.—Studebaker's regular source for stampings for passenger car and truck bodies. The cab assembly is integrated in massive steel framing fixtures, being spot-welded by means of portable guns developed here. Following framing, the cabs are transferred onto dollies and carried along on the body-in-white mechanized conveyor. On this line the assembly is completed by spot-welding and torch-welding, doors are installed, etc.

The cabs now are ready for cleaning and painting; for these final operations they are processed through the body paint shop. Painting is followed by hardware and trim installation and the babs are then transported to the final assembly lines for installation in the chassis. (*Turn to page* 82)

(Below) After the impregnated plies of glass cloth are transferred to the female mold, a vacuum is produced with a small vacuum pump to make use of atmospheric pressures.

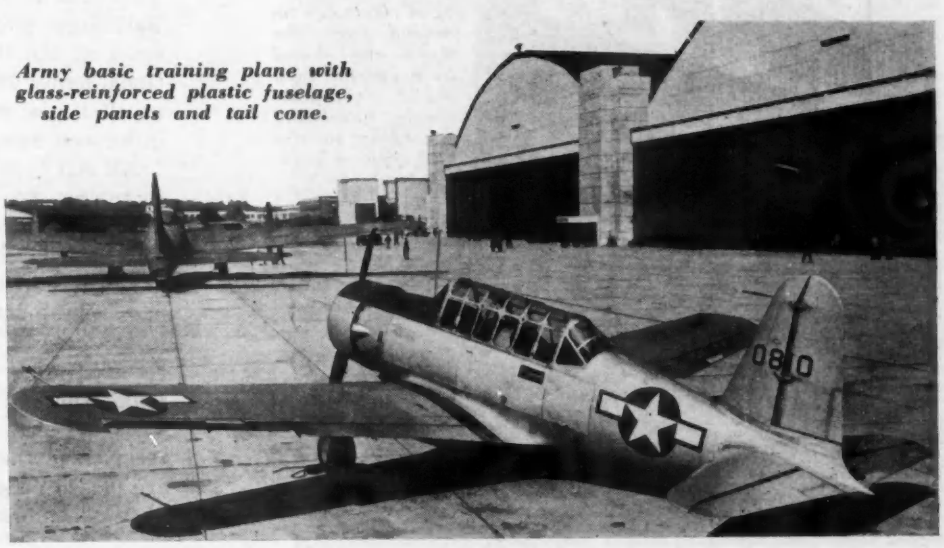
(Above) For fabricating the glass-reinforced plastic fuselage, plies of glass cloth impregnated with a resin are laid over a male mold. The plies, comprising a complete half of the fuselage skin, are trimmed before transfer to the female mold.

Army *Experimental Plane Has Glass Reinforced* Plastic Fuselage

SUCCESSFUL flight tests of an Army basic training plane equipped with a glass-reinforced plastic fuselage, side panels, and tail cone, have culminated a research program initiated by the Army Air Forces Materiel Command, Wright Field. The experimental plastic fuselage is of sandwich construction comprising a balsa wood core between an inner and outer skin of plastic reinforced with fibrous glass cloth. Ground destruction tests of three fuselages of the same design—one of glass-reinforced plastic, one of metal, and one of plywood—indicate that for equivalent weight the glass sandwich fuselage is considerably the stronger.

On a strength-weight basis the glass-reinforced fuselage is reported to be 50 per cent stronger than the metal fuselage and 80 per cent stronger than the wooden fuselage now in service. Firing tests have indicated that the glass-reinforced fuselage would be satisfactory under gunfire. The material did not flower and high explosive projectiles failed to detonate because of the low density of the material. (*Turn to page* 212, *please*)

Army basic training plane with glass-reinforced plastic fuselage, side panels and tail cone.



Automatic control, Centralized distribution,

Solve Rivet

By C. O. Davis
Methods Engineer, The Glenn L. Martin Co.

OF ALL the problems arising out of wartime expansion at The Glenn L. Martin Company, none has proved more bothersome than the procurement, handling, distribution and salvage of rivets. Every airplane added to the production quotas has meant another 200,000 to 3,000,000 of these all-important pieces of metal, and even as the number of rivets rose, so did the variety of types and sizes specified by the Engineering Department.

After several attempts to set up controls without changing former methods of bulk distribution, it soon became apparent that the rivet was on its way to becoming a major bottleneck unless radical steps were taken. The first such step was the introduction of cellophane rivet packaging. While this represented a marked improvement over anything previously tried, and did reduce the burden then being placed on sifters, magnetic separators, cleaning and degreasing units and hand and mechanical sorters used for salvage operations, it was still a long way from perfection, and the Tool Design Methods Group was assigned to make a detailed study of the entire rivet problem.

This study probed every phase of the procurement, handling, storage, distribution and conservation of both DD (icebox) and AD rivets, and has resulted in the establishment of entirely new procedures for rivet handling based on a centralized storage, packaging and distribution area. Although this procedure has been in effect for only a comparatively short time, its effect is already being felt in the form of reduced manhours and uninterrupted rivet flow.

Since approximately 95 per cent of all rivets used by the Martin company are purchased already coated from outside vendors, factory-made rivets being used only to fill occasional unavoidable gaps between outside vendor deliveries, the starting point of the rivet line is the Raw Stores Department. All purchased rivets are sent directly to this point following a careful examination for flaws in tolerance and material by Receiving Inspection, and shipped from there to the Central Rivet Packaging Area as needed. Occasionally, a few rivets are received from the vendor minus the protective coating. These are degreased, anodized in 10 per cent chromic acid solution, heated to 95 F for one hour and hardened at room temperature before being placed in storage.

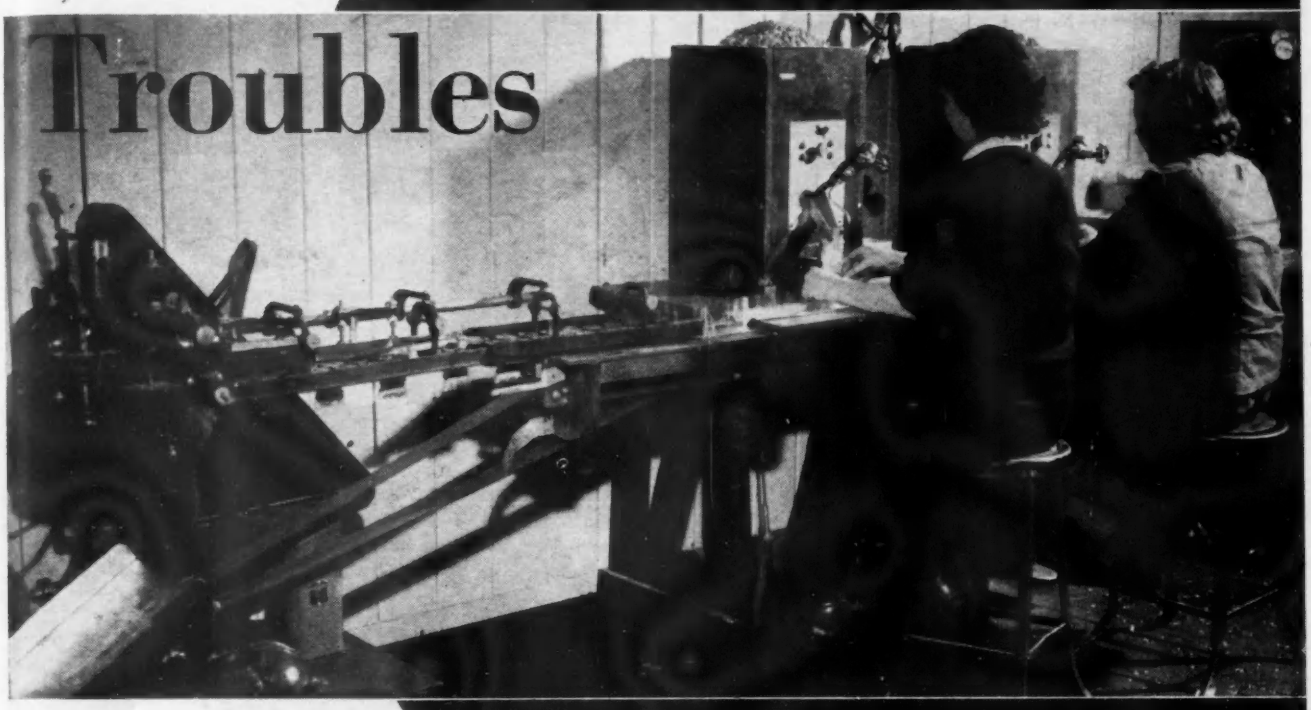
In the Rivet Storage Area the boxes of packaged rivets are removed from the truck and stored in a special rack with compartments numbered according to size and type of head.

When requisitioned from Raw Stores, the previously inspected rivets are placed in special boxes and shipped to the Central Rivet Packaging Area to be placed in bulk stock. This area is located in Plant 1, but serves all Baltimore plants. In addition to the bulk stock at the Rivet Packaging Area, an additional buffer stock of bulk rivets is maintained at all times in Raw Stores at the plant for unforseen emergencies.

All AD type rivets are issued to the manufacturing floors in sealed cellophane bags. Thousands of these bags are used daily, and they are purchased in lots of 4 or 5 million per order, with delivery controlled to 300,000 bags semi-monthly to assure a steady flow. As in the case of the rivets, these bags are first received and delivered to Raw Stores and requisitioned from this point as needed.

As the bags are withdrawn from stock and received in the Central Packaging Area, they are placed on a #904 Addressograph Machine, and code numbers are printed in a block on

Troubles



the bag. Cellophane bag material #300 MSAT is used in the current packaging system, with instructions printed on each bag in yellow ink. A recent innovation, however, calls for other colors to be used to distinguish between the various types of rivets and materials. Thus red ink will be used for 100-deg countersunk head rivets, green for rivets of Monel material, blue for 78-deg countersunk head rivets, and orange for rivets of various other materials used on a special contract. The bags printed as required, and upon completion, are placed in specially designed humidified cabinets capable of holding several days' supply.

Rivets are loaded into the bags with an auto-

(Top) Loading AD type rivets into cellophane bags at The Glenn L. Martin Co. in Baltimore. These two machines package all rivets for the Martin Baltimore plants. The loaded rivet bags are placed on a conveyor and carried through a machine that automatically folds, seals and punches the package

(Center) This rivet truck is loaded in the Central Rivet Area and services assembly floor rivet stations on regular schedule. Two trucks are used for each plant so that one is always being loaded while the other is out on delivery

(Bottom) Packaged rivet stations similar to the one shown here are located throughout the assembly areas. They are serviced at regular intervals by a special rivet truck

Martin-Designed Machines for Salvaging Rivets from Floor Sweepings

(Upper left) Separating steel parts from the aluminum rivets by means of an electromagnet

(Upper right) This machine sorts the rivets according to shank diameter
(Lower left) Here universal head rivets are separated from countersunk head rivets

(Lower right) In this machine rivets are sorted according to length. It also can be used to separate the rivets according to head type

matic volume type loader of Martin design. Two of these machines are mounted on a table over a two-inch conveyor belt. Bulk rivets are placed in the hoppers of the machines and a supply of bags in special holders under the rivet spouts. The rivets are fed automatically from the hopper into a controlled volume chamber, and unload periodically into a gravity feed chute to the bag. A small jet of air opens each bag as it comes to the front of the loader, and a predetermined quantity of rivets pours out of the spout into the bag. The loaded bags are removed by operators and placed on the conveyor, which carries them through an Amsco Rotary Sealing Machine, where they are folded, sealed, punched, and finally expelled into a container.

Completed lots of packaged rivets are removed from the machine and placed in storage cabinets where a week's supply for the entire plant (this includes the Army and Canton Divisions as well as Plant 1) is maintained at all times. Satisfactory humidification is obtained in these cabinets by the simple expedient of placing a water tray at the bottom and permitting the moisture to circulate. Tabs fixed to the front noting the rivet codes identify the contents of all drawers. Rivet sizes are stocked in sequence throughout, while different styles are kept in separate cabinets.

But packaging the rivets was only one phase of the job. A second and equally important one was the delivery of the packaged rivets to the manufacturing

(*Turn to page* 112, *please*)

Airbriefs

By Henry Lowe Brownback

Engines

The engine builder is always up against the problem of making an engine which is light enough to power a small plane and yet big enough not only to give the power the plane builder asks for in the beginning but will ask for after he has sold a few planes and decides to add comforts and gadgets which make the original fifty horsepower airplane need sixty to fly it. Add to this the fact that the private flyer will, some day, land in the field of a friend out in the country and find his gas low. He will, nine times out of nine, go to the nearest filling station and get "high test" motor car fuel and run on it. If his engine can do this he will be all right but if it requires high octane "Aviation" fuel he will damage his engine or wreck himself and blame the engine builder. Back in the days when I was building engines people claimed that they were heavy for their power. Maybe they did weigh ¼ pound per H.P. more than the lightest ones but they were run in on the test stand with an ordinary flight prop, high test automobile gasoline and no cowling. I realise that one cannot do this sort of thing where ounces count as they do on an airliner or bomber but on something which John Smith is going to use for fishing trips I like to play safe.

Airports

Many of the big cities of the country have built tremendous airports representing a great expenditure of public funds in order to attract airplane travel to them. In many cases these airports are at a considerable distance from the center of the city a fact which nullifies, to a great extent, their usefulness save for long distance flights where the time saved in flight can overcome the time lost in getting to and from the airport and the inconvenience.

These airports have had to handle both private and public service planes and with increased air travel after the war this condition will become intolerable both from a safety standpoint and from that of loss of time waiting for a landing or take off.

This country made terrible mistakes in laying out or rather in *not* laying out adequate road programs when the motor car began to be a factor. Towns and villages grew up along the narrow highways either bottlenecking them or else forcing the roads to new localities removed from congestion. Even with the new type roads one is forced to trail a 100 horsepower motor car which can climb a 10% grade at just about full speed behind a truck and trailer going up the same grade at five miles per hour.

The time to avoid a similar mess in aviation is now and not after every suburban area has been partly subdivided making condemnation proceeding almost impossible. The cost should not in any case be born by the taxpayers directly but should be financed by a city "Authority" which would charge enough to make them self supporting.

The areas for these airfields should be big enough to take care of all possible traffic *twenty years from now* and adequate accommodation provided for both public and private planes with approaches so laid out that there will be no danger of cross traffic and an adequate system of high speed roads built or provided for so that a trip to and from an airport does not result in a half hour crawl through Sunday motor car traffic.

An Aeronautic Echo

A recent acquisition of the Metropolitan Museum of Art of New York is this terra-cotta model for a monument to commemorate the invention of the balloon in France in 1783 by the Montgolfier brothers. The model, shown in the Metropolitan Museum of Art photograph reproduced above, was made in 1784 by the noted French sculptor Clodion and was entered in a competition held by King Louis XVI. The first ascension took place on June 5, 1783, and others quickly followed marking the first flights of man into the air.

Navigation

I think that I have mentioned a navigation machine. This instrument which is at present too bulky for plane use holds great promise for almost automatic navigation when its bulk can be reduced. The makers claim the present ground set up will almost automatically "fix" a longitude within eighty feet. Present navigational methods are not especially tricky but involve some simple mathematics and a knowledge of the stars which most men do not have and are afraid to tackle. In the air with the tremendous speed of aircraft the problem becomes far more difficult so any mechanical means of finding it through a sort of cash register affair with a telescope would be a blessing to mankind both in the air and on the sea.

Rockets

It is becoming increasingly evident that the rocket will replace much clumsy, heavy and expensive artillery. The only factor which worked against the rocket was the difficulty of aiming it and now radio control seems to be getting under way. I am told by men from overseas that the German plane-launched winged rockets are guided not only by radio but by some mechanism in their "Innards" which takes a fix on the target and guides the rocket to it.

Power Eggs

The idea of making interchangeable power plants in toto is not new but it has never been brought to the state of perfection which might have been achieved had a little more thought been given to the subject. The Germans and the English have gone a long ways not only in making the whole power plant into an interchangeable "egg" which can be taken out just by disconnecting a few pipes and controls but they have gone still further in making the eggs so that different motors can be used without disturbing the balance of the ship and so that liquid cooled and radial aircooled engines can be used inter-

(*Turn to page* 92, *please*)

Curtiss-Wright Facilities for the

Fabrication of Large

SUPPLEMENTING the generalized description of Curtiss-Wright facilities for the production of military airplanes, published in AUTOMOTIVE AND AVIATION INDUSTRIES, August 15, 1943, the following article touches briefly on some of the details of the fabrication of large airframe sections.

To introduce this analysis, attention is drawn to the fact that the C-46 airframe structure is integrated from 25 major sub-assemblies, each of which is built up from individual stampings, forgings, etc.

As mentioned in the first article, a major portion of the plant facilities are set apart for the production of the C-46. The general scheme of final assembly is an S-shaped assembly line in which the first two stages take the major phases of assembly, preparatory to the installation of wings and final clean-up, including installations of the engines; the third stage being the final assembly and preparation for flight testing. Sub-assembly work on the fuselage is done in a department adjacent to these assembly lines.

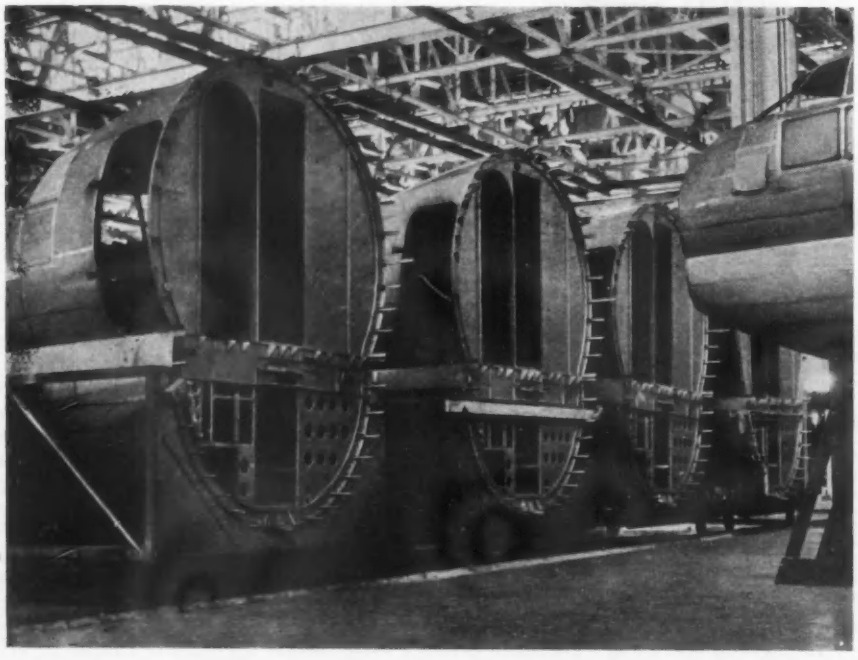
During sub-assembly fuselage sections are transported by overhead cranes to succeeding stations and finally the entire fuselage assembly is carried by crane to the beginning of the assembly line, where it is lowered onto the production line cradle. From this point on to the pre-flight station, the airplane is rolled on rails, being moved intermittently from station to station by drag chain.

The larger sub-assemblies such as the center panel section are handled in massive framing fixtures, mounted on rollers and moved along on rails.

The P-40 final assembly line is arranged in somewhat similar fashion. For its final assembly stages on the line the Pursuits are moved on fabricated angle iron dollies rolled on an inverted V-track at a continuous rate of 30 feet per hour. The casters of the dollies are formed to a V-shape this conforming with the rails.

The pictorial section is replete with views selected in various stages of C-46 and P-40 sub-assembly, providing an excellent visualization of the various operations. Too, these views emphasize the massiveness of the fixtures in keeping with the principle of interchangeability of sub-assemblies. It is a fact that with such fixtures Curtiss-Wright has been able to produce parts that conform to high standards of quality and alignment so essential to the requirements of mass production assembly.

In view of the enormous amount of detail involved in the fabrication of major sub-assemblies, we have selected as an example the assembly of the C-46 center panel section. An outline of the principal stages of assembly operations is shown on the following four pages.

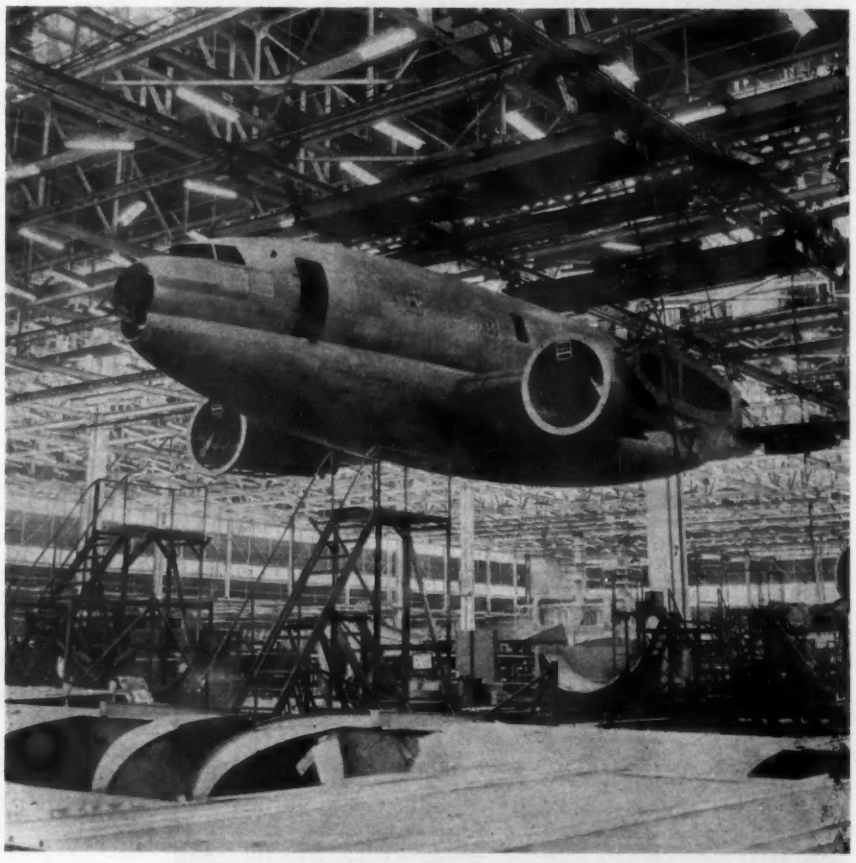


(Left) View of the nose sections of the Curtiss C-46 awaiting installation of all possible controls and equipment before splicing to the main fuselage sections.

(On bottom of opposite page) General view of the plant devoted to the assembly of the C-46 COMMANDO. The planes on the left move toward the foreground and those planes to which the outer panels have been attached, move toward the hangar door at the far end of the building. The heavy drag chain which moves all the planes simultaneously at definite intervals, can be clearly seen in the foreground.

Sections

By
Joseph
Geschelin



The completed C-46 fuselage is lifted from the secondary splice fixture where the nose and tail sections and the two nacelles were added. It is on its way to the production line cradle where it will begin its long trip along the S shaped production line.

1. Horizontal Position, Bottom Up

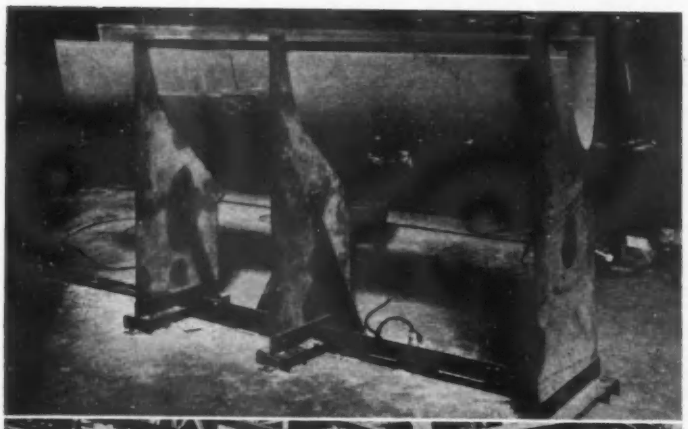
Installation of spars
Handling plates installed
Nose assembly installed
Intermediate ribs installed
Bolt and rivet closure assembly to intermediate ribs
Locate and drill lower match angle
Install assembly in trunnion dollies

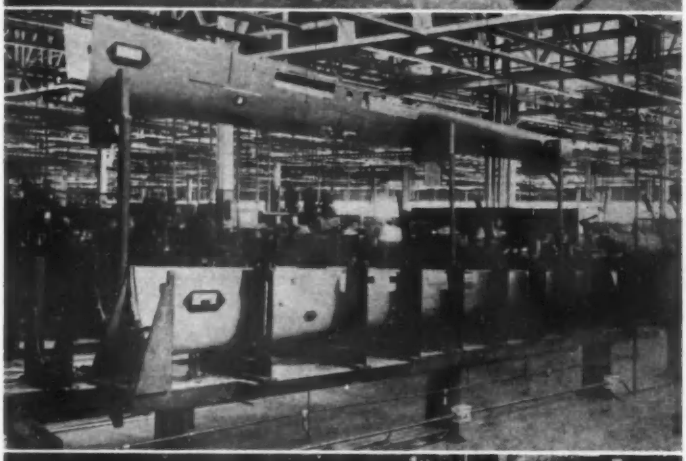
2. Vertical Position, Nose Up

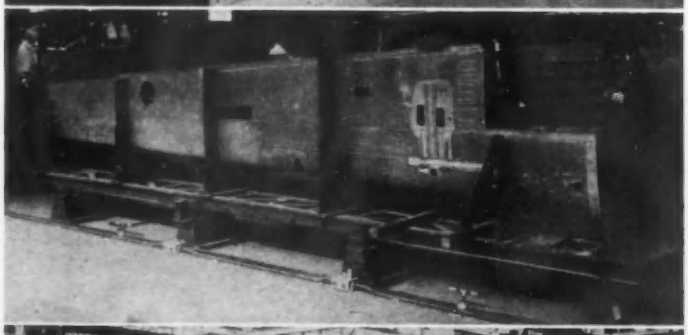
Center panel turned to vertical nose high position and lay on top skin assembly
Turn center panel to horizontal position, top side up

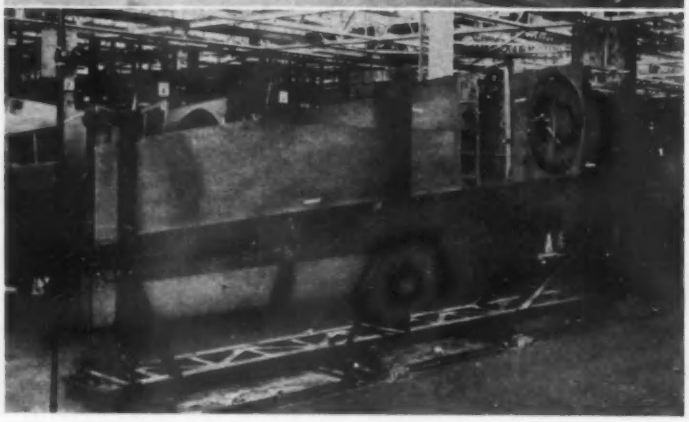
3. Horizontal Position, Top Up

Tack and rivet top skin
Drill top match angles









Wing Assembly in Five Stages Shown in order from top to bottom:

First stage of wing assembly—portion of the wing nose in its assembly fixture.

Second stage of wing assembly — integration of the wing nose sub-assembly in a massive stationary fixture.

Third stage of wing assembly—wing nose sub-assembly undergoing final assembly operations when transferred onto the movable assembly line.

Fourth stage of wing assembly—with the wing nose sub-assembly as the backbone, the wing panel begins to take final form.

Approaching the final stage of wing panel assembly—the wheel pocket and additional webs and skins are here installed before removal to the main fixtures.

4. Vertical Position, Nose Up

Rivet top skin assembly to splices and rib flanges

Partially rivet match angles

5. Same Position

Rivet stringer clips on top skin

Complete riveting of match angles

6. Horizontal Position, Top Up

Drill and ream fuselage attach holes

Locate drill and attach floor assembly

Rivet longerons

7. Vertical Position, Nose Up

Rivet floor stringer to panel

8. Same Position

Rivet floor frame to panel

9. Vertical Position, Nose Up

Install and rivet skin to splices and rib flanges

Partially rivet match angles

10. Same Position

Rivet stringer clips on skin

Finish riveting match angle

Partially rivet aft floor plates

11. Same Position

Screw and rivet aft floor plates

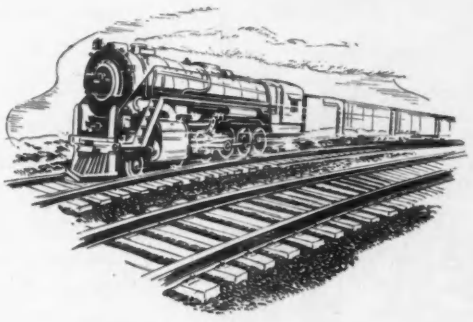
12. Vertical Position, Nose Down

Locate, drill and rivet under fuselage attach clips

Locate and drill all nacelle attach angles

Drill all landing gear holes

(*Turn to page* 38, *please*)



War Traffic Still Grows

The Railroads Need Your Help to Meet the Growing Invasion Traffic

American railroads are performing a herculean task in handling the country's swollen wartime traffic. In this time of huge jobs and of unusual accomplishments, theirs stand out as almost incredible.

Despite the shortages of manpower, equipment, and materials which beset all industry today, American railroads continue to handle the ever-growing load placed upon them.

Freight traffic in 1943 amounted to 725 billion ton-miles—14 per cent above 1942, and passenger traffic in 1943 increased to 85 billion passenger-miles—58 per cent more than in 1942. Facilities were stretched to what seemed their limit to meet the demands of 1942. Yet in 1943 the increased traffic was handled with less than one per cent more freight cars, and with practically the same number of passenger cars. Remarkable as their past performance is, American railroads will be called upon to excel it in 1944, handling even more men and materials as we go into the critical, invasion phase of the war.

Meeting these huge transportation demands requires the complete cooperation of all shippers—loading cars to capacity, holding car detention time to the minimum, and doing everything possible to boost operating efficiency and car utilization. By careful planning Inland Steel Co. has speeded up car loading and unloading, and has increased the average weight of outgoing carload shipments 30% over prewar shipments. During the past two years Inland has thus saved literally thousands of valuable car-days.

Continued public support of American railroads is needed to speed men and materials to Victory. They need our help and deserve it.

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INLAND STEEL COMPANY

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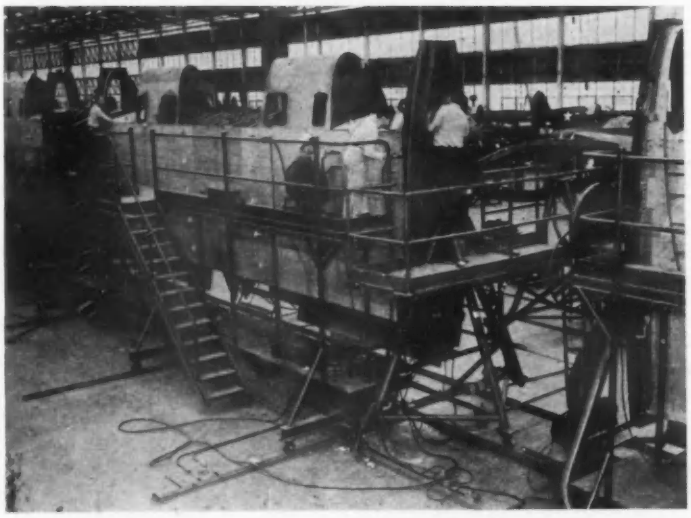


Main center section of the C-46 panel in its jig turned in the vertical position. These fixtures pivot on the horizontal axis to facilitate the various operations. Note that the jigs are movable and roll on rails.

22. Same Position

Complete all riveting and clean up
Move to primary splice fixture

By contrast with the development of the huge C-46 center panel section, we give below an outline of the assembly operations on the P-40 wing panel which is easily the largest single element of the Pursuits.

1. Webs of all types are fabricated in stationary fixtures.
2. Two pieces of nose section are placed in stationary fixture and riveted together, bulkheads and first web are installed.

13. Vertical Position, Nose Up

Finish riveting forward floor plates

14. Same Position

Rivet all nacelle attach angles

15. Horizontal Position, Bottom Up

Rivet under panel fuselage section

16. Horizontal Position, Top Up

Bolt to landing gear fittings and longerons
Screw nacelle attach angles to panel angles

17. Same Position

Screw assembly nacelle fairing
Partial screw assembly of nacelle panel attach angles

18. Same Position

Rivet nacelle fairing
Finish screw assembly of nacelle panel attach angles
Locate and screw on top fairing

19. Same Position

Rivet nacelle spar ring
Partially rivet panel-nacelle attach angles

20. Same Position

Completely rivet panel - nacelle attach angles

21. Same Position

Install nacelle fillets

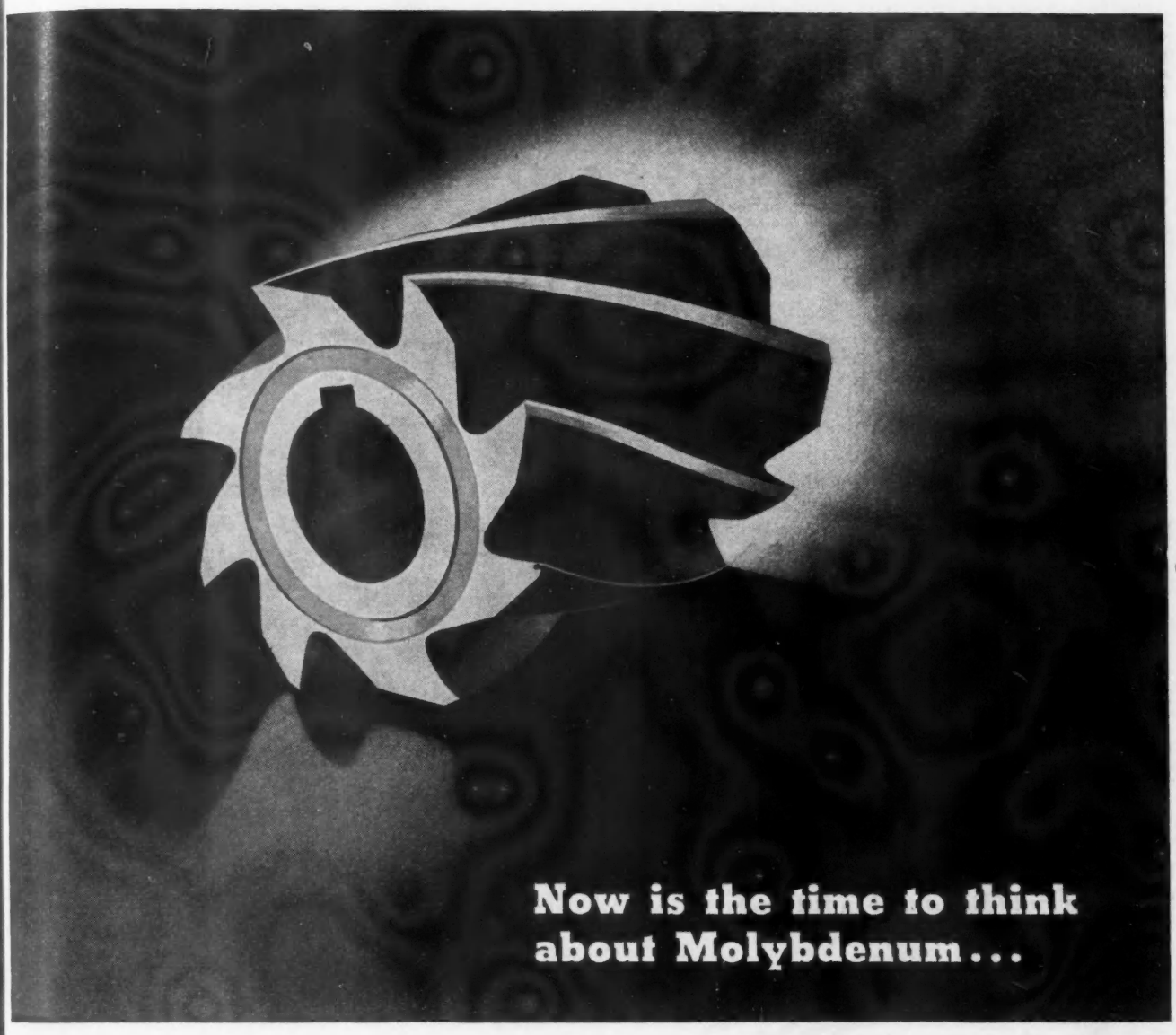
Moving Fixture Line

3. Nose section assembly with bulkheads and first web is transferred to moving fixture line. The general procedure is to start from the nose of the panel and work toward the trailing edge. The panel is placed on edge, with the nose section or leading edge resting in the fixture.

(*Turn to page* 40, *please*)

(Top right) P-40 fuselage assembly being produced on the waist-high production line. Here is a close-up of the assembly of the top half of a P-40 fuselage.

(Bottom right) Fuselages of the Curtiss P-40 are made in halves as shown and will be joined later in a mating fixture.



It is generally appreciated that the item of perishable tool costs is an important factor in manufacturing accounting. The possibility of savings offered by using molybdenum high speed steels, instead of tungsten types, is therefore worth consideration.

The savings are due first to the lower cost per pound of molybdenum steels, and second to their lower density. The latter results in more tools from an equivalent poundage.

The net savings effected naturally depend on tool performance. It is an established fact that, in a substantial majority of careful comparative tests made in the past, the performance of properly heat-treated molybdenum steels equaled, where it did not better, that of tungsten steels.

A consultation with your supplier should confirm these statements, but it would be a simple matter to check them in your own plant.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

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Climax Molybdenum Company

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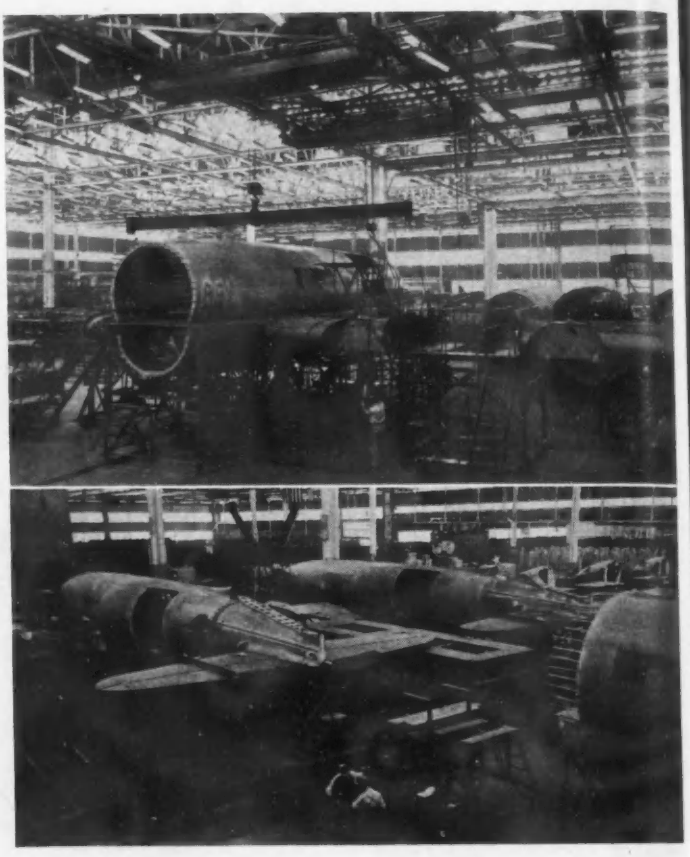
MOLY

(Top) The forward and aft main sections of the Curtiss C-46 are spliced around the center wing panel in this primary splice fixture. It is shown being lifted by crane from this fixture and will be placed in the secondary splice fixture.

(Right below) Secondary splice fixture in which the nose and tail sections are joined to the center sections of the C-46 fuselage.



4. More bulkheads are attached to first web. One fuselage fitting and chassis bulkhead forgings also are installed.
5. Assembly is painted.
6. Second web and more bulkheads are added.

Moved to Stationary Fixture

7. First pair of top and bottom skins are added.
8. Third web installed.
9. More bulkheads, wheel pocket bulkheads and auxiliary web assembly are added.
10. Third and fourth top and bottom skins are located in position and drilled.
11. Skins removed.
12. Panel assembly is removed from stationary fixture and moved to main fixtures.

Panels Installed in Main Fixtures Which Are Set Up to Hold Right and Left Panels

13. Third and fourth skins riveted.
14. Wheel pocket skins installed.
15. Fourth and fifth webs installed.
16. Fuselage attach angles installed.
17. Trailing edge assembly installed (flap area).
18. Trailing edge skin installed (aileron area).
19. Match angles of panel are installed as work progresses in fixture. Moved from main fixtures and placed in cleanup dollies.

Removed from Cleanup Dollies and Layed in Flat Position on Rolling Production Line Dollies as Separate Right and Left Panels

20. Flap operating rod and hold down ring installed.
21. Match angle trimmed.
22. Control cables and pulleys installed.
23. Trailing edge skin closed and riveted.
24. Flaps installed.
25. Panel is shaken to discover any loose parts or tools left in.

Panels Placed on Edge Position in Rolling Production Line Dollies as Separate Right and Left Panels

26. Miscellaneous parts added and cleanup operation.
27. Center line bulkhead between right and left panels installed.
28. Right and left panels mated and bolted.
29. Ammunition doors added.
30. Holes are drilled in fuselage attach angles by means of movable jig which is swung into position on panels.

Removed from Production Line Track

31. Gun mount brackets installed.
32. Cleanup operation.
33. Camouflage paint job.
34. Final inspection.
35. Delivery to final assembly line or spares.
36. Guns and ammunition boxes installed on final assembly line.

The foregoing description is necessarily brief and sketchy owing to enormous number of detail operations involved in the fabrication of large military airplanes.

Reclaimed Synthetic Rubber Scrap

Synthetic rubber is now being reclaimed by the United States Rubber Co. Early estimates showed that thousands of pounds accumulated during the manufacture of synthetic rubber items would be useless unless new methods were found to reclaim it. New formulas were compounded until processes were developed which have now made possible the reclaiming of more than 1,000,000 pounds to date. A supply in excess of 5,000,000 pounds is available that can be added to the country's stockpile.

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No wonder gasoline motors purr when treated with Permatex Toon-Oyl! All motors need:

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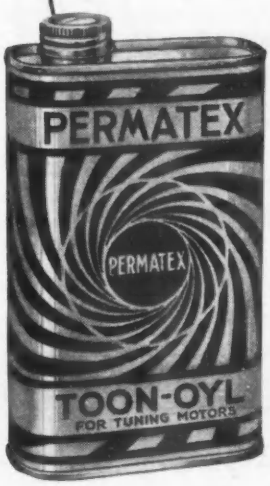
Permatex Toon-Oyl cleans and lubricates clogged piston rings and sticky valves . . . Stops motor "buck" and ignition "ping" . . . Increases pick-up and power.

For smoother, more satisfactory performance, urge car owners to include a quart of Permatex Toon-Oyl in each oil change.



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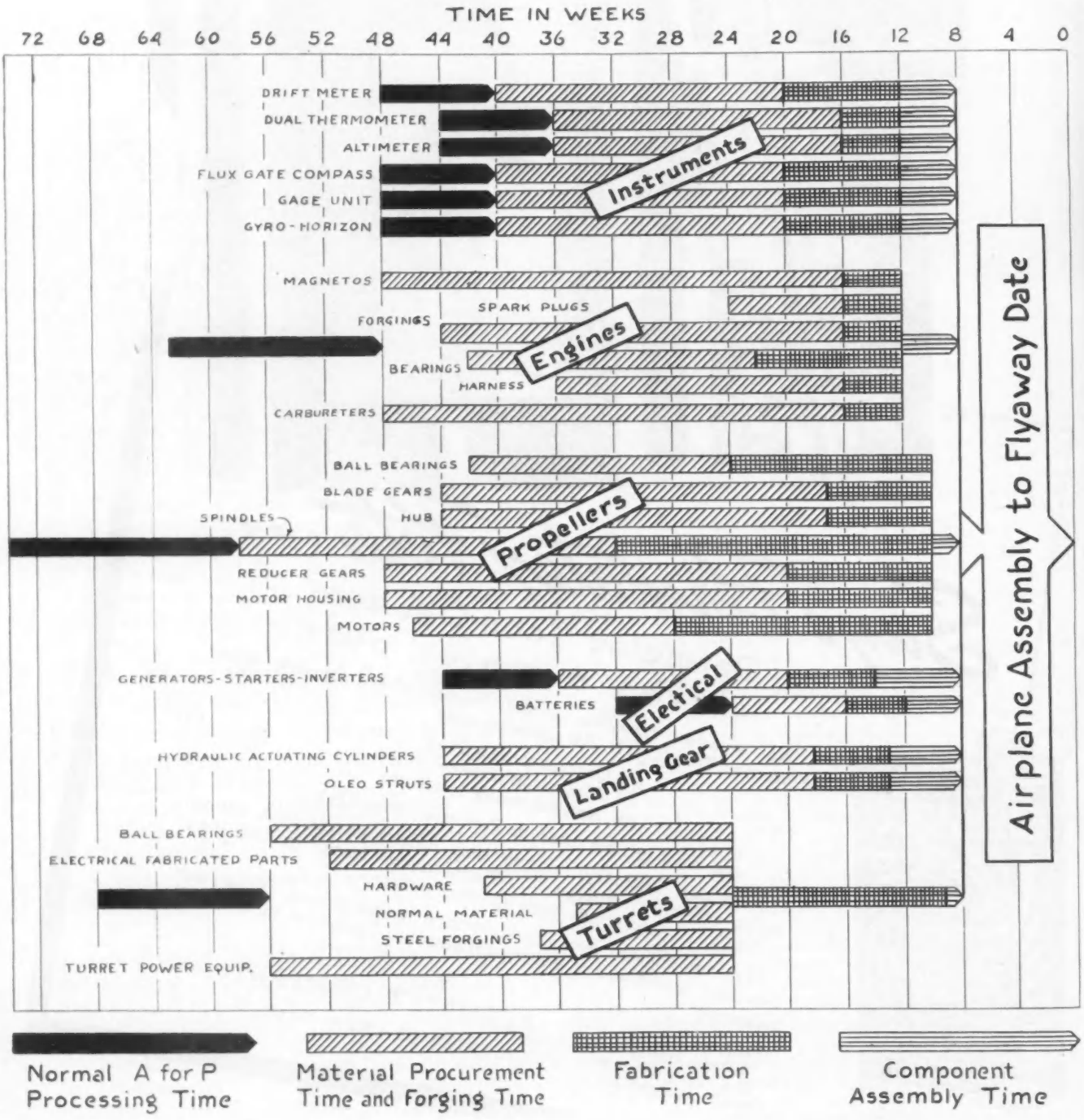
Procurement and Manufacturing Time Cycle

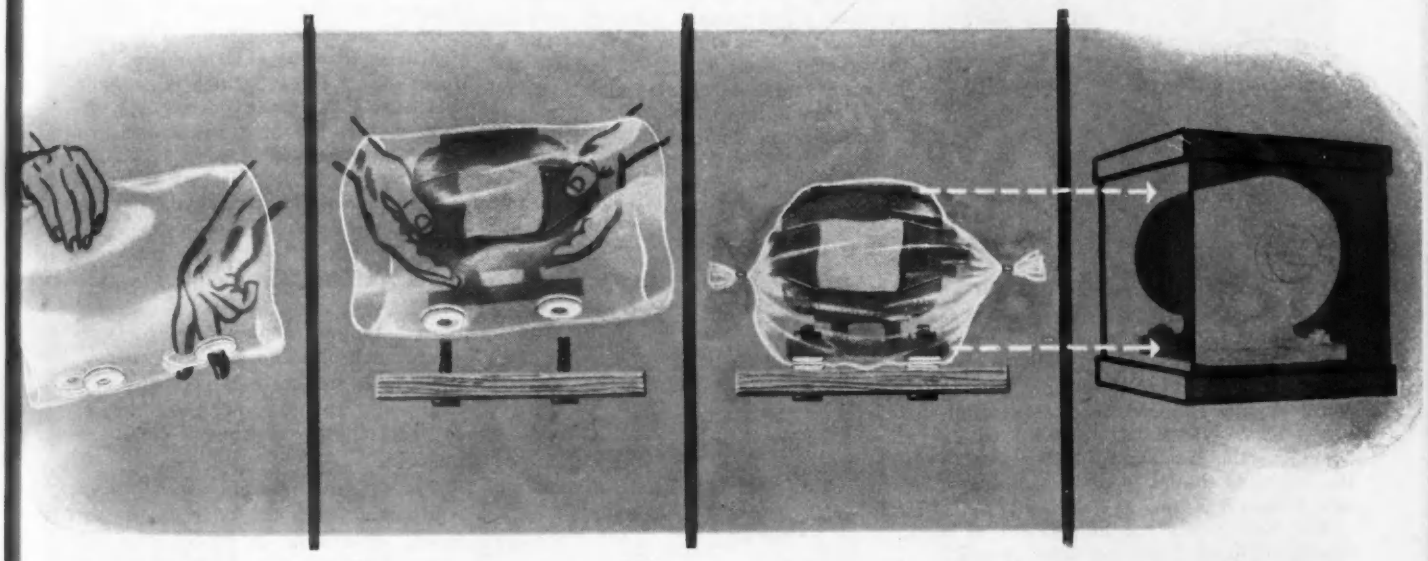
for Major Aircraft Components

THIS chart was prepared for the Aircraft Scheduling Unit by the Components Branch, Resources Control Section of the Production Division, Materiel Command of the Army Air Forces at Wright Field. The majority of the components is Government Furnished Equipment. Normal authority for purchase processing time required by the Government for replacement of contracts has been shown in order to depict the over-all procurement cycle. In general the chart also applies to Contract Furnished Equipment items.



Each step is a vital step in Method II Packaging

Choice of right materials comes first—then plan each step to give maximum protection to both product *and package*.



Superior *long term* protection for precision metal parts and assemblies is the outstanding contribution of Method II packaging. This type of package features a transparent, moisture-proof bag with a dehydrant enclosed—keeps moisture out—provides unmatched protection against corrosion.

Method II packages serve long and dependably when properly engineered. Here, briefly, are points of greatest importance:

1. Selection of right packaging materials is essential in Method II. Saran Film moisture-vapor-proof bag or "Floating Bag" (see illustration) is recommended for this use. Its remarkably low moisture-vapor transmission more than meets Government requirements for this type of package.
2. Precision metal parts or motors are properly cleaned, and covered by "Floating Bag." No messy preservatives required. Then parts are mounted on platform, relieving bag of all stress. Note gaskets on bag permit bolting—protecting the membrane from damage, and providing a moisture-vapor-proof seal. Adequate quantity of desiccant—based on moisture-vapor transmission rate of barrier and estimated period of storage—is securely attached within bag.
3. Barrier is then sealed (by lead sealing rings in this illustration).
4. Finished package provides external protection for barrier and product. Entire package is easily handled and inspected. Most important, parts can be quickly unpacked—free from heavy grease—ready for immediate use.

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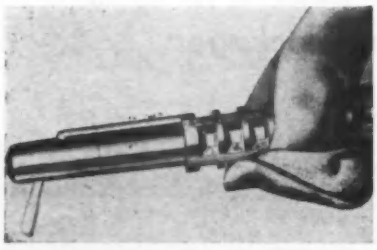
New Production Equipment

A NEW Rod Saver is the latest addition to the line of Suregrip electrode holders manufactured by Martin Wells and distributed by Air Reduction Sales Company. It features a reinforced snap-on insulator cap made of heavy plastic. The cap is notched on the inside so that it slips over the vise body and is held in place by a steel spring. No screws are required to hold it, hence the danger of arcing due to contact with exposed screws is eliminated. Insulators can be replaced by breaking the damaged insulator with the chipping hammer and snapping a new one into place.



Rod Saver with snap-on insulator cap

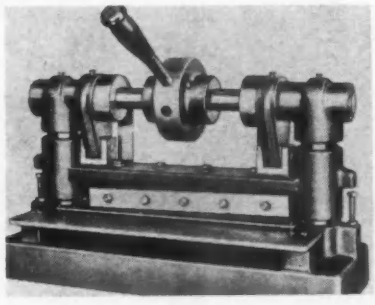
The Rod Saver rod hole is set at a 60 deg angle and accommodates through 5/16-in. rods. Because it has no protrusions, it is particularly suited to operating in close quarters, the manufacturer states.

THE Norton Simplex lapper, a recent development of the Norton Company, Worcester, Mass., incorporates many of the features of the Norton Crank-O-Lap. It is designed for simultaneous finishing operations on one or several cylindrical surfaces.

Norton Simplex lapper

Surface finishes as low as one micrometer rms are said to be obtainable in a single operation. One bearing or several on a work piece can be finished in a fraction of a minute. Designed for versatile and quick-change operation, the Simplex will also handle concentric and/or eccentric cylindrical portions at the same time, as well as such sections as the pins of the short-throw cranks on compressors, and the journals and eccentric members of small camshafts.

The Norton Simplex Lapper has a capacity from ½ in. to 2 in. on diameters, with lengths up to 24 in. It uses abrasive coated paper strips applied to those surfaces on which reduced friction and initial wear is desired.



Di-Acro shear No. 3

O'NEIL-IRWIN MANUFACTURING CO., Minneapolis, Minn., has recently placed on the market the Di-Acro shear No. 3. This new shear includes a precision adjustment for accurately stopping blade travel, which permits the shear to be readily arranged for a large variety of slitting and notching operations, to extremely close tolerances.

A metal stripping guide, moving with the shear blade, is mounted upon the unit to allow the shear to be employed for stripping all types of materials to extremely narrow widths.

A delivery chute, built within the unit, will deliver all materials at any speed within the ability of the operator to feed the shear. This feature allows material that has been sheared to be automatically loaded into a receptacle without attention from the operator.

The new Di-Acro shear is of heavy construction, the main bed casting of machine tool grey iron weighs 80 lb and provides a sturdy base for the foundation of the complete shear.

The finished unit weighs in excess of 150 lb with all moving parts properly weighed and balanced to distribute shearing load.

THE Ellstrom master square, made to gage block standards, is now in production at the Dearborn Gage Company, Dearborn, Mich. The square features an upright member in the form of a cylinder, which is screwed to the base. As wear develops, a fresh new surface can be brought into use by loosening the screw and turning the cylinder slightly. Use of a cylinder rather than a flat surface also increases accuracy, because the piece being checked cannot help but make proper contact against the rounded surface.

All surfaces are hard chromium plated, lapped to finish accuracy of 10 micro inches. The life expectancy of the unit is further extended by the fact that both upright and base are made of thoroughly seasoned gage block steel.

The square is easier to use than most equipment in its class, due to the broad ¾-in. wide base on which the workpiece can rest. The base, like the upright, is finished to surface accuracy

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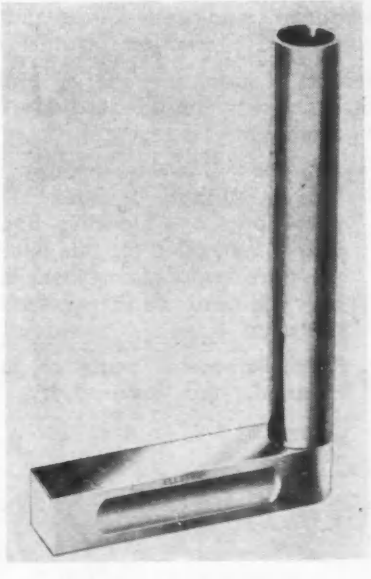

Ellstrom master square

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Increasing Emphasis on Super-Bombers and Long Range Fighters

1944 Munitions Program of $74 Billion Will Be 36% Aircraft, According to March 1 Estimates by Army and Navy

Volume production of major airframe parts and sub-assemblies for the B-29 Superfortress at a steadily increasing rate is being attained by the Fisher Body Division of General Motors Corp. Utilizing facilities in eight of its 16 armament production plants, Fisher Body is supplying 12 major parts for the B-29. The huge Cleveland Aircraft plant, originally scheduled for final assembly of the B-29, was switched last year to the manufacture of the P-75 long-range fighter plane, but despite this revision in plans Fisher Body is undertaking to produce more than 80 per cent of its original contract. Fisher Body is producing all the B-29 nacelles used by the three companies assembling the Superfortresses—Boeing at Seattle, Bell at Marietta, Ga., and Martin at Omaha. Other parts produced by Fisher Body are rudders, ailerons, elevators, outboard wings, flaps, horizontal and vertical stabilizers, dorsal fins, tail gun turrets, rudder pedals and exhaust collector assemblies. Plants at Cleveland, Detroit, Lansing and Grand Rapids figure in this program, which represents the largest single contract held by the division.

Chrysler, Hudson and Goodyear are among participants in the terminated program for B-26 airframe sub-assemblies who have changed over to parts for super-bombers. Final B-26 airframe sections from these plants were delivered in March to the Glenn L. Martin-Nebraska Co. at Omaha, which also has converted to the larger plane. Hudson also is the recipient of a recent contract for wing sections from Lockheed for the P-38 fighter plane. Another Hudson airframe job is that of armor-plated cabin sections for the P-39 fighter under sub-contract to Bell Aircraft Corp.

Aircraft engines continue as an important product in the automotive industry's war program. Buick Motor Division of GM, which already has delivered approximately 45,000 Pratt & Whitney R-1830-43 engines from its Melrose Park, Ill., plant for installation in B-24 bombers and C-47 cargo planes, is preparing to produce two new types of the same Twin Wasp series. The new 14-cyl. types are the P. & W. R-1830-75 and the R-2000-9, the former being a more advanced version of the R-1830-43 for installation in Liberator bombers and the latter being used to power the C-54 four-engine Douglas Skymaster cargo planes. The two new contracts involve upwards of $60,000,000 and call for extensive retooling and new machinery. Stand-in machinery will be temporariily installed in the plants to expedite production while the present machines continue on the current types of engines.

Chevrolet Motor Division of GM manufactured more than 10 per cent of the aircraft engines turned out by U. S. industry last year, the total exceeding 23,500 power plants, as the 1943 national output aggregated 235,338 engines. Chevrolet's 1943 production rate was five times that of 1942. Chevrolet has been producing Pratt & Whitney 14-cyl. engines of the R-1830 series since March 30, 1942, with final assembly at North Tonawanda, N. Y. Conversion of part of these facilities to the new P. & W. R-2800-C engine, which develops upwards of 2,100-hp, has been started and is expected to be completed in seven months. Ford Motor Co., which is making the P. & W. R-2800 engine at the Rouge plant, produced 45 per cent more engines in March than in December, despite some labor stoppages in the former month. March output also represented a 16 per cent increase over February. Packard Motor Car Co. has shipped nearly 35,000 engines for war use, representing approximately 47,000,000-hp, since

(*Turn to page* 116, *please*)

Sheet Mills Hard Pressed To Keep Pace with Demand

Ordnance Needs Are Expected to Be Featured by Rising Requirements for High Caliber Munitions

By W. C. Hirsch

Pending developments in the European battle zones that will justify WPB officials in permitting more of a relaxation in the war program, metal market conditions remain basically unchanged. The recent upward spurt in steel output is ascribed chiefly to increased demand for shell steel. Ordnance needs are expected to be featured during the summer months by rising requirements of high caliber munitions, and this is likely to make for a tight situation in the supply of steel billets and other forms of suitable semi-finished material. Demand for steel plate from builders of landing equipment is being for the most part met fairly promptly. Sheet mills are hard pressed to keep pace with the demand, which is especially insistent for 16 gage hot rolled material to be used in the forming of the Navy's 55-gallon gasoline drums. That WPB is losing little time in bringing production more closely in line with consumption, where unneeded excess capacity is evident, is shown by its recent order to shut down two additional lines at the Government-owned aluminum reduction plant in Queens, N. Y. Production of aluminum has been running in excess of requirements, WPB officials stated, and recently came word that certain foreign requirements that had been expected to absorb some of the surplus had been substantially curtailed. The shutting down of the two Government-owned reduction plants aids materially in reducing coal consumption not only in the now idle units, but also in the transporting of alumina from the South. The closing order affects only the production of primary aluminum metal. Not only is production of sheet aluminum, extrusions, castings and forgings not in excess of demand, but sheet rolling mills are having difficulty meeting the demand because of the loss of many of their workers to the armed forces. In the aluminum rolling and finishing industry the prompt action of the Government comes in for commendation, although these secondary processors are not directly affected by it. The growth of an impression of top-heavy capacity at the base, resulting, as it

(*Turn to page* 80, *please*)

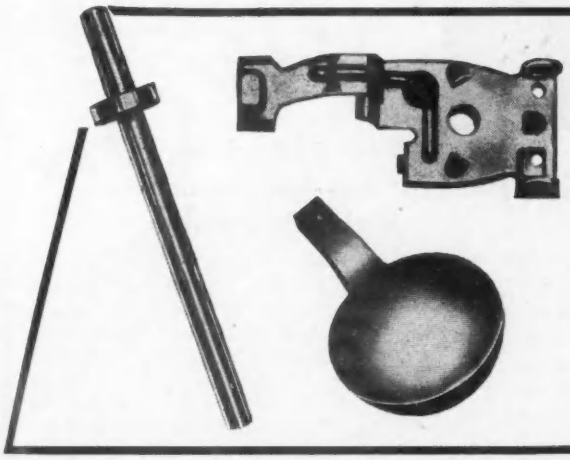
WHICH **Stainless Steels** for these parts?

● The answer to selecting the proper Stainless grade for a specific job requirement may depend upon any of a dozen factors—fatigue strength, lighter weight, corrosion resistance, heat resistance, easier fabrication, etc.

And that is one reason why many designers and production men are turning to Carpenter for help with their Stainless design and fabricating problems for product improvement and cost reduction. Carpenter has long been their general headquarters for useful information about Stainless Steels.

How many ways are there for you to profit through our diversified experience in solving Stainless problems? Need fabricating assistance, or data on the corrosion and scale resisting properties of various types of Stainless Steel?

Or could you make use of personal assistance in the shop? If so, get in touch with your nearby Carpenter representative. You may be able to use his experience to lick a tough design problem, or simplify production methods to increase plant output. You'll certainly find it worthwhile to have a chat with him to discuss your Stainless Steel requirements.



It takes a wide range of Stainless properties *for the economical production of ladles for non-ferrous metals, switch parts and valve stems. The ladle must resist high temperatures, while the switch part is made from ductile Stainless Strip that makes possible intricate shapes and sharp bends. And still another Stainless is used for the long-wearing valve stem.*

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UAW-CIO Meets Setback in Efforts to Secure Industry-Wide Wage Stabilization

WLB Decides That Increasing Pay Rates in Waco, Tex., Would Seriously Unstabilize Wages in That Area

Efforts of the UAW-CIO to secure industry-wide wage stabilization and equal pay for equal work in all parts of the country met a setback recently when the National WLB turned down a request by North American Aviation Co. for higher rates at its Waco, Tex., plant. The company requested that rates at Waco be equalized with those prevailing in the North American plants at Inglewood, Cal., Kansas City, Kan., and Dallas. The Waco plant has been operating under a temporary wage schedule authorized by the regional WLB at Dallas, with rates approximately 10 cents per hour lower than most rates in the company's other plants. The other North American plant rates are included in the Southern California air-frame industry wage schedule which was adopted following a WLB order in March, 1943.

The majority opinion of the WLB in the Waco case, with the labor members dissenting, said, "We have denied the application because the present rates are in excess of the going rates in the Waco labor market area and because it is our opinion that increasing these rates further would seriously unstabilize wages in that area. We are aware of the cogent arguments advanced in favor of corporation-wide uniformity of rates but we think that where application of such uniformity would result in seriously unstabilizing rates in a labor market area, this factor must be taken into account in making a decision under the wage stabilization program." Despite the fact that airframe wage cases have been regarded by the WLB and the director of economic stabilization as "rare and unusual" cases "which warrant special consideration in the interest of effective prosecution of the war," the opinion went on "we do not believe that the fact that a case may be deemed to be a rare and unusual case should give 'carte blanche' for the establishment of rates entirely without regard to the going rates in the labor market area."

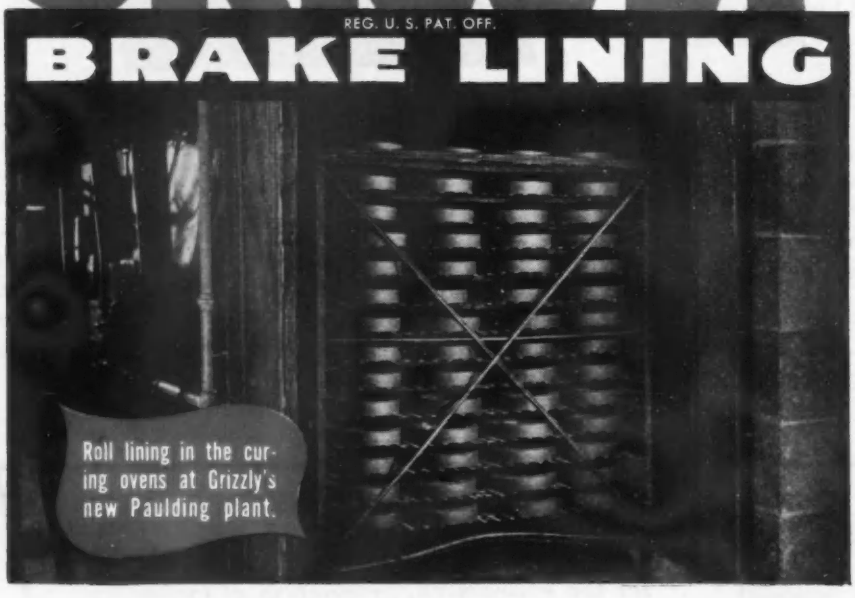
In a similar case recently, the Detroit Regional WLB denied the request of the UAW-CIO for payment of the Chrysler Detroit Tank Arsenal wage scale at the Newcastle, Ind., plant of Chrysler Corp. where the 1270 employes are paid going rates in that area

(*Turn to page 76, please*)

GRIZZLY

REG. U. S. PAT. OFF.

BRAKE LINING



"...under *all* conditions of service!"

● Loads are heavier, now. Trucks, buses and cars are working longer hours—in every kind of weather—under every adverse condition. Brakes must respond with utmost efficiency, stamina, and dependability.

This calls for Grizzly, finest product of the brake lining industry. Grizzly Brake Linings are all moulded, then cured under scientifically-controlled heat. They are non-absorbent, non-glazing, will not swell or separate. Grit and sand will not become imbedded in them. The strong wire-grid foundation prevents pulling off or working loose.

These factors, plus Grizzly's uniformly high coefficient of friction throughout entire thickness and life, assure superior braking performance with maximum freedom from adjustment *under all conditions of service!*

Manufacturers: The Grizzly Engineering Staff welcomes your inquiry concerning any brake lining problem—address the Engineering Department of the Paulding plant.

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Warehouse Stocks In Principal Cities

Ford in England Signs Agreement With Trade Union

A joint statement issued in London by the English Ford Motor Co. and the Trades Union Congress has announced the signing of an agreement between the company and the trade union movement as a result of discussions in the first place between Lord Perry, chairman of the company and Sir Walter Citrine, general secretary of the Trades Union Congress.

Officials of the company, the statement continues, met leading representatives of several trade unions and a joint negotiating committee was appointed. A spirit of cooperation and good will characterised the discussions throughout and the procedure agreed upon by the negotiating committee has been endorsed by all the trade unions concerned; it is embodied in the agreement that has been signed, the first to be entered into between the parties since Ford commenced operations in England 33 years ago.

BUILT TO YOUR REQUIREMENTS . AUTOMATIC ELECTRONIC CONTROLS
HYDRAULIC PRESSES FOR POWDER METALLURGY
ACCURACY IN DENSITY . UNIFORMITY AND ALIGNMENT
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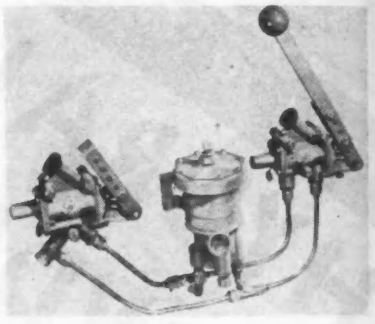
New Products for Aircraft

Improved Isodraulic Remote Controls

Recent improvements in Isodraulic remote controls, have been announced by Adel Precision Products Corp., Burbank, Cal. The diaphragm and auxiliary chamber of the equalizer unit have been eliminated, simplifying design and the servicing of the system. Synchronizing screws by-passing the pistons of the "master" and "slave" units permit bleeding and filling the system at one point, without breaking any line connections, and provide rapid indexing of lever positions.

The two-line system provides smooth, accurate response at the "slave" unit to motion in either direction initiated at the "master." It is now available with or without an integral lock, which in the "slave" unit of the irreversible system, maintains the selected position against load and vibration. Locking system and piston design have been improved to reduce the handle load to 4½ lb. for the irreversible system and 2½ lb. for the reversible system, using an 8-in. lever.



Isodraulic remote control

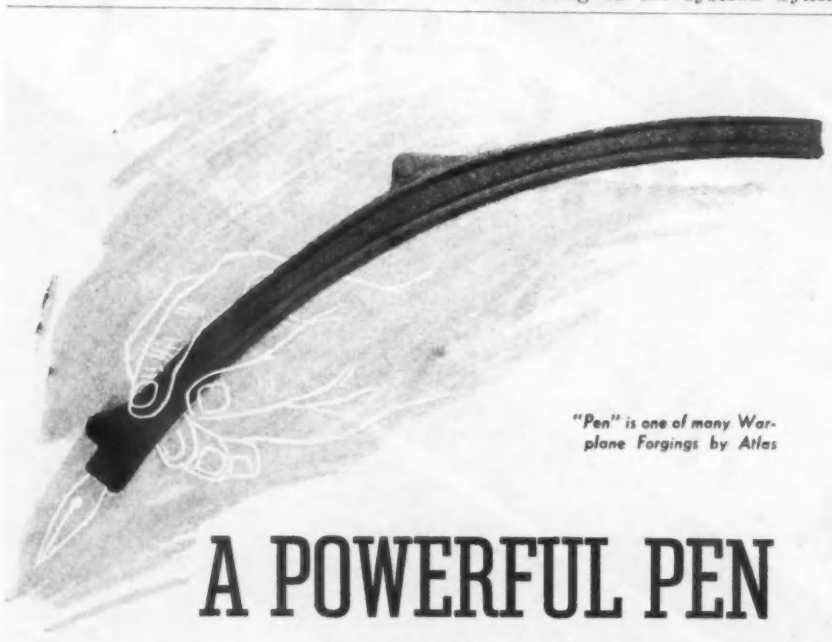
The Isodraulic control system is said to be completely immune to temperature effects. Operating efficiently in temperatures ranging from 160 F to —65 F, it remains in synchronism through temperature changes, or with sections of the system at different extremes of the temperature range.

The units can be mounted in any position, and at varying elevations. Stacking width of master and slave units is 1¼ in. Total weight of the three units is less than 3¼ lb.

Eclipse Fluid Metering Systems

Eclipse fluid metering systems consisting of metering pumps, filters, check and pressure valves and controls are designed by the Eclipse-Pioneer Division of Bendix Aviation Corporation, Teterboro, N. J., to provide a metered flow of fluid required for propeller anti-icing, carburetor anti-icing, windshield anti-icing, and aircraft unit heaters. They operate from 24-volt d-c power supply, and Type 1415 will pro-

(*Turn to page* 106, *please*)



"Pen" is one of many Warplane Forgings by Atlas

A POWERFUL PEN

to write the Peace that must come first

By putting every effort to War production; by investing every available dollar in War Bonds, We, the People of America, are writing the real Peace terms now,—a document that will need but two words—"Unconditional Surrender."

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ATLAS DROP FORGINGS

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that challenges future effort

Promises are just promises unless kept; but performance is history. That's why we are proud of our Army-Navy "E" award. It expresses Uncle Sam's recognition of our contribution to this nation's production record . . . a performance that will live in history. As such, our "E" is not only a symbol of a vital job well done but an inspiring challenge to the men and women of General Controls. ★ We pledge ourselves to continue giving our best, and more, to produce Automatic Controls for America's needs. Today, tomorrow and until "V" Day, we will continue to earn our "E" by *performance*.

hi-g
GENERAL CONTROLS

Wartime Manufacturers of Electro-Magnetic and Temperature Controls for Aircraft

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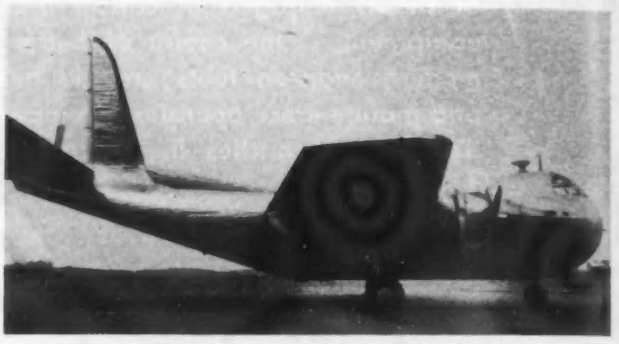
Welded Stainless Steel in Air Cargo Plane



The Budd "Conestoga" provides a roomy, full-height operating compartment in the nose of the plane.

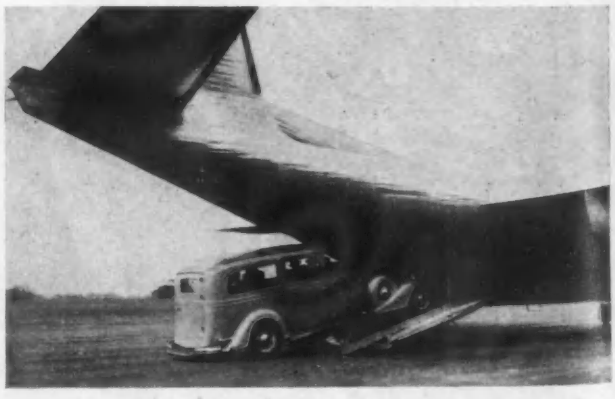
THIS new air cargo plane, known officially as the "Conestoga," has been put into full scale production by the Edwin G. Budd Manufacturing Company in its new airplane plant near Bustleton on the outskirts of Philadelphia.

The cargo carrier is of a new type which utilizes welded stainless steel for the first time, on any considerable scale, in the history of the design of military and commercial aircraft.

The plane is a two-engine transport 68 ft long, with a wing spread of 100 ft, and is capable of transporting 10,400 lb of cargo over a range of 650 miles under A.C.A.A. license. Its 14-cylinder radial air-cooled engines deliver 1200 hp each for take off and have a normal rating of 1050 hp. In tests the plane demonstrated that in normal operation it could lift 10,400 lb of payload off the landing strip in a run of 920 ft.

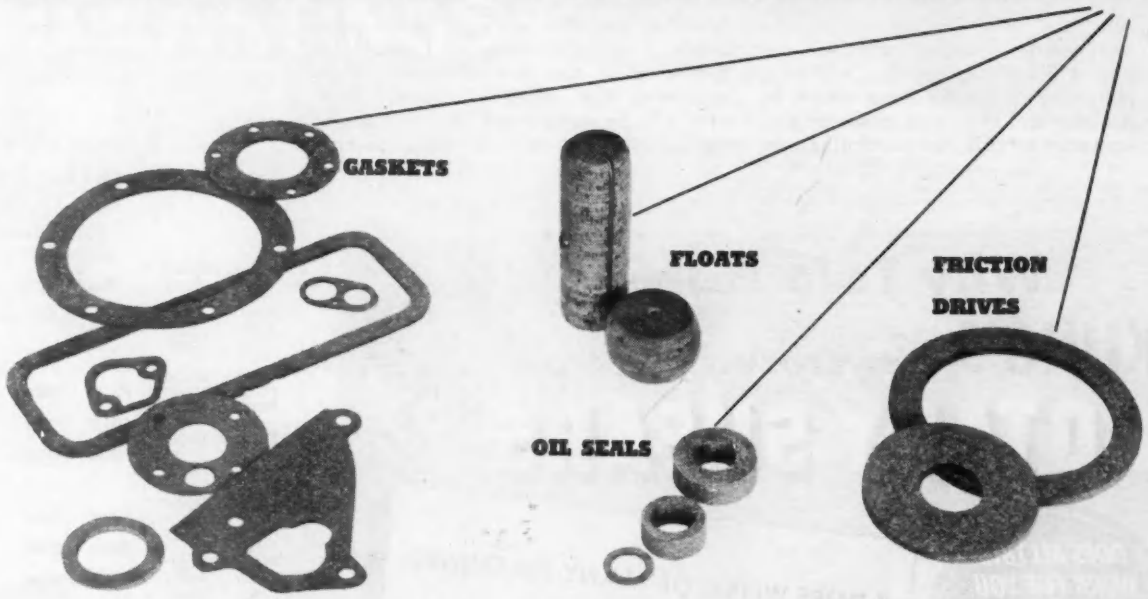
Aside from its type of construction and unique appearance the plane's most distinguishing characteristic is its provision for carrying cargo, and a ramp to facilitate its loading and discharge. The cargo compartment is a space 25 ft long, 8 ft wide and 8 ft high wholly unobstructed by structural members. The plane is equipped with a large cargo hatch in the underbody. This hatch may be lowered to form a ramp to the surface of the landing field, or a loading platform level with the platform of a truck. Back of it are two large clearance doors which may be lifted

(*Turn to page* 60, *please*)



View of the new plane showing the cargo hatch lowered and the large clearance doors lifted.

7 properties make CORK an ideal material for



CORK is the only known substance that has all seven of these useful properties: compressibility without side flow, resilience, high coefficient of friction, resistance to liquid penetration, light weight, stability, and low thermal conductivity. That's why cork, supplied by Armstrong in its natural form and in numerous fabricated compositions, has proved the most efficient and economical material for hundreds of aircraft and automotive applications.

Natural cork is excellent for gasoline tank and liquid level indicator floats . . . provides a low-cost plug for protecting interior threads during shipment or spray painting . . . serves as a protective cushion in glass-to-metal assemblies. When granulated cork is combined with various binders, cork's usefulness is greatly broadened. Armstrong's Cork Compositions are widely used as gaskets, oil-retaining rings, valve discs, and friction wheels. Some of these compositions are coated with synthetic rubbers, resins, or glue for imperviousness to certain fluids . . . laminated with cloth, treated paper, or fiber for additional strength . . . or coated with oil and graphite for reduced initial friction.

In addition to cork products, Armstrong supplies the aircraft and automotive industries with many types of synthetic rubber, cork-and-rubber, fiber, felt, and flooring materials. Write us about your specific requirements. Armstrong Cork Company, Industrial Division, 1505 Arch Street, Lancaster, Penna.

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MATERIALS AND SPECIALTIES FOR AIRCRAFT AND AUTOMOTIVE UNITS

- **Gaskets, packings, seals,** piston cups, bushings, and valve seats—for gauges, fuel lines, meters, hydraulic systems, and other equipment
- **Composition roll goods,** with or without fabric back, plain or adhesive-coated—used as glazing strip, binding tape, cushion pads, anti-skid flooring and gaskets
- **Tank strap cushions**
- **Sealing materials** for specialized aircraft equipment handling aromatic fuel
- **Felts** for vibration-damping and soundproofing
- **Wingwalk materials**
- **Resilient floorings**
- **Carburetor floats** and other fabricated natural or composition cork specialties

Engineering Ideas For Postwar Trucks

By Fred B. Lautzenhizer

Formerly Chief Transportation Engineer, International Harvester Co.; now Automotive Engineering Consultant, War Production Board

WHAT the user of postwar trucks will want, or better, what his operations will actually require, will be a complete line of trucks from which to select a size and type with capacity and performance to suit his particular job. Ignoring the 100 per cent tailor-made truck, a complete line, as I see it, is presented in the accompanying table. Assuming that a manufacturer's 1946 line will be designated the "F" series and adding that part of the gross rating to the designation indicating hundred-pound increments of gross rating, we have a simple method of listing models and one that all manufacturers could use.

If either the engine under seat or the cab forward type should be eliminated, I suggest that it be the EUS, for the CF, save for its longer turning radius and longer parking space, can do practically anything that the EUS can. In addition, its construction makes possible

Why Tojo Hates
KLING'S Improved Design
ROTARY SHEARS
DOES ALL THIS WORK FOR YOU
1 CUTS STRAIGHT LINES
2 CUTS RINGS—SMALL OR LARGE RADII
3 CUTS CIRCLES
4 MAKES FLANGES
5 CUTS INSIDE HOLES WITHOUT CUTTING IN FROM EDGES
6 JOGGLES & OFFSETS
7 CUTS ODD SHAPES
8 BEVELS OF ANY ANGLE
9 CUTS REVERSE CURVES
10 BEADS & U'S
ALL WITH Hairline PRECISION
1 DOES WORK OF MANY MACHINES
2 SHEARS STEEL UP TO 1 IN. THICK
3 CUTS WITH HAIRLINE PRECISION
4 INCREASES PRODUCTION
5 DECREASES SHEARING COSTS
Yes, here's a machine that so greatly speeds up production and saves so much time that Tojo could easily hate it as much as he hates our big bombers and tanks. Kling's Rotary Shear is possibly the most amazing rotary shear you have ever seen. Its revolutionary design and construction give you EXTRA features and many advantages over other type rotary shears. It does the work of many machines—quickly and economically, when provided with the proper attachments. Any one can operate it! Of rugged construction, with double hardened cutters and V belt drive that absorbs jolts, it shears without burrs and with hair line precision. Cuts mild steel up to 1 inch thick, alloy metals in proportion to hardness. Many other special features such as anti-friction, high-speed bearings, oil bath gearing, friction clutch, wear resistant alloy steel parts, result in a unit that decreases operating costs, maintenance upkeep and provides a longer-over-all efficiency.
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KLING BROS. ENGINEERING WORKS
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KLING ROTARY SHEARS

Gross Ratings of "F" Series Trucks for 1946

4 x 2 Straight Trucks

Conventional Model	Conventional Gross	Engine Under Seat Model	Engine Under Seat Gross	Cab Forward Model	Cab Forward Gross
FC50	5000	....	....	FF50	5000
FC75	7500	....	....	FF75	7500
FC100	10000	....	....	....	....
....	....	FU130	13000	....	....
FC135	13500	....	....	....	....
FC150	15000	FU150	15000	....	....
FC160	16000	....	....	FF160	16000
....	....	FU170	17000	....	....
FC180	18000	....	....	FF180	18000
....	....	FU190	19000	....	....
FC200	20000	....	....	FF200	20000
FC220	22000	....	....	FF220	22000
FC240	24000	....	....	FF240	24000
....	....	FU250	25000	....	....
FC260	26000	....	....	....	....
....	....	FU270	27000	....	....
FC280	28000	....	....	FF280	28000
FC300	30000	FU300	30000	FF300	30000
FC400	40000	....	....	....	....
FC500	50000	....	....	....	....

6 x 2 Straight Trucks

Conventional Model	Engine Under Seat Model	Cab Forward Model
FC200D	FU200D	FF200D
....	....	....
FC240D	....	FF240D
....	FU250D	....
FC300D	....	FF300D
....	FU320D	....
....	....	....
FC400D	....	FF400D
....	FU420D	....
....	....	....
....	....	....

6 x 4 Straight Trucks

Conventional Model	Engine Under Seat Model	Cab Forward Model
....	....	....
FC220L	FU220L	FF220L
....	....	....
....	....	....
FC320L	....	FF320L
....	FU340L	....
FC400L	....	FF400L
....	FU420L	....
FC700L	FU700L	FF700L
FC800L	FU800L	FF800L

***4 x 2 Tractor Trucks**

Conventional Model	Engine Under Seat Model	Cab Forward Model
FCT240	....	FFT240
....	FU250	....
FCT300	....	FFT300
....	FUT320	....
FCT400	FUT400	FFT400
FCT500	FUT500	FFT500
FCT600	FUT600	FFT600
FCT700	FUT700	FFT700
FCT800	FUT800	FFT800

***6 x 4 Tractor Trucks**

Conventional Model	Engine Under Seat Model	Cab Forward Model
....	....	....
....	....	....
....	....	....
....	....	....
....	....	FFT500
FCT600L	....	....
....	FUT700L	FFT700L
....	FUT800L	....

* Gross weights for tractors cover total train gross.

Index to Model Designations:

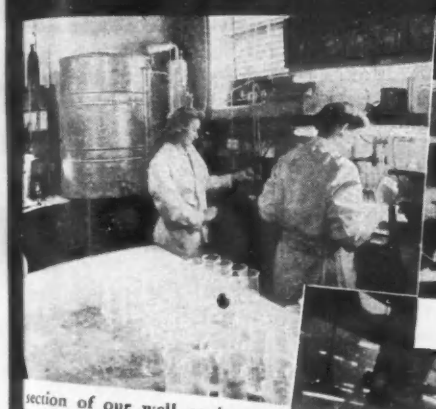
F = 1946 production (G = 1947, H = 1948, etc.)
C = Conventional front end.
U = Engine under seat.
F = Cab forward, front end.
T = Truck-tractor.
D = Dead third axle.
L = Live third axle.

Typical Identifications of Models:

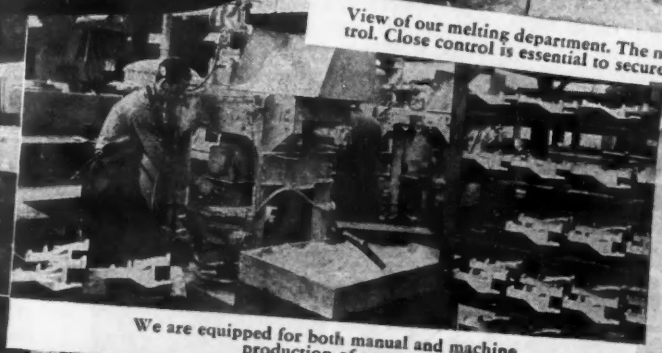
FC-160 = 1946 production 4 x 2 conventional 16,000 lb. GVW.
FU-300 = 1946 production 4 x 2 engine under seat 30,000 lb. GVW.
FF-240 = 1946 production 4 x 2 cab forward 24,000 lb., GVW.
FU-420D = 1946 production 6 x 2 engine under seat 42,000 lb., GVW.
FCT-600L = 1946 production 6 x 4 conventional tractor 60,000 lb., GTW.

You can depend on HILLS-McCANNA MAGNESIUM ALLOY SAND CASTINGS

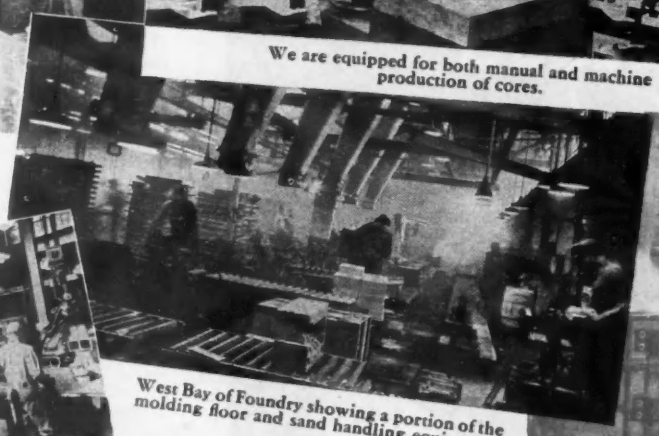
View of our melting department. The metal is melted with close pyrometer control. Close control is essential to secure the ultimate in physical properties.



section of our well equipped oratory where all heats under- severest analysis.



We are equipped for both manual and machine production of cores.

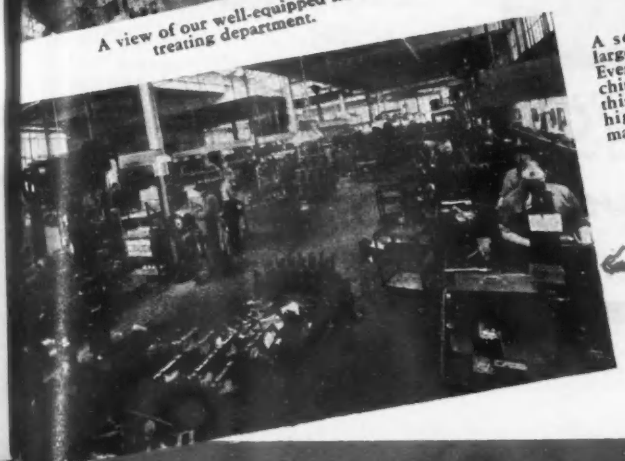


West Bay of Foundry showing a portion of the molding floor and sand handling equipment.

ction of our cleaning department. Here oper- s perform the various jobs of burring and nding castings to remove seams, parting lines l fins.

X-ray department where castings receive inspection for possible hidden flaws.

A view of our well-equipped heat treating department.



A section of our large machine shop. Every type of machine is available in this department for highest precision machining.

We offer you—

COMPLETE FACILITIES FROM PATTERNS to LABORATORY—HEAT TREATING AND MACHINING

Uniform results in magnesium castings are dependent upon the physical equipment and personnel of the foundry. Hills-McCanna are completely equipped for the production of magnesium castings. Our highly trained personnel, physical and chemical control, inspection and testing, all contribute toward the utmost in quality, coupled with dependable service.

The views shown here evidence our ability and capacity for flawless production of today's war time needs . . . and tomorrow's products of peace.

Let us discuss the application of Hills-McCanna Magnesium Alloy Castings to your needs.

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Proportioning Pumps · Air & Water Valves · Chemical Valves
Marine Valves · Force-feed Lubricators · Dowmetal Castings

longer bodies with better distribution of weight and the absence of excessive overhang over the rear axle. Another strong point is its lower cost of production.

For engines to power such a line a reasonable provision would be sufficient torque output to permit at least 20 mph on 3 per cent grades in not more than one transmission reduction below direct, or at least 1 hp per 400 lb of GVW, a requirement that would not necessarily apply to "off highway" vehicles. This would mean a torque output of at least 0.78-lb-ft per cubic inch of piston displacement. The torque curve should be flat from 1000 to 2000 rpm. There should be removable cylinder sleeves, counterbalanced crankshafts, crank case ventilation, and an oil cooling system. For the heavier units Diesel liquefied gas power plants should be provided.

The transmissions for vehicles up to 10,000 lb gross should have four forward speeds; for 12,000 to 18,000 lb, five speeds with direct in fifth and also five-speed overdrive in fifth optional at no extra cost; for 20,000 to 27,000 lb, six speeds with overdrive in sixth; for 28,000 lb and up, eight speeds (two-speed range unit) with direct eighth and overdrive optional at no extra cost. These transmissions should be interchangeable, so as to overlap into the next gross rating above or below. They should have permanent contact helical gears and quiet overdrives.

Other items that should be mentioned are: live front axles with transfer cases to make 4 x 4 and 6 x 6 units out of various models; rear axles with a wider range of ratios than has been available in the past, and, on all six-wheel units, walking beam or axle centers of 48 to 56 in. to provide ample clearance for large tires; springs that are truly progressive; power-actuated steering gears for the heavier models; and brakes that are power actuated on all models, with full air on those of 20,000 lb gross and up.

Such accessories as oil coolers, engine ventilators, combination engine governor-carburetor units, road speed or propeller shaft driven governors should be available on a factory in-built basis. In the past, when such equipment caused trouble after having been installed by the dealer or user, the truck itself was blamed.

Finally, although vehicles that are constantly in the public eye can stand "dolling up," the general run of trucks do not need it. Good visibility, on the other hand, and comfort for the driver, and convenient and easily operable controls will pay big dividends in the driver's care of the equipment and loyalty to his employer.

This article is an abstract of the paper, "What the Transportation Engineer Wants in Postwar Motor Trucks", which was presented by Mr. Lautzenhiser at the April 20 meeting of the Metropolitan Section of the Society of Automotive Engineers.

Automotive Profit Margin Cut in Half

The profit margin of automotive companies on total sales has been cut in half in the past four years, according to George Romney, managing director of the Automotive Council for War Production.

Net income after taxes in 1943 amounted to 4.1 cents per dollar of sales, compared with a profit showing of 8.3 cents in the peacetime year of 1940, it was shown in a survey of 36 automotive vehicle and parts manufacturers whose 1943 annual reports are available.

The margin of profit on sales in the automotive industry has been steadily dropping, the year by year comparisons being as follows:

Year	Net Profit
1940	8.3%
1941	6.7%
1942	5.2%
1943	4.1%

In 1943, total taxes paid by automotive concerns were more than twice as great as net earnings after federal taxes. Out of every $1 of sales, 8.5 cents were paid out in taxes.

In 1943, for every $1 of net income the tax collector took $2.07, while in 1940 the tax ratio amounted to $1.11 on every dollar of income.

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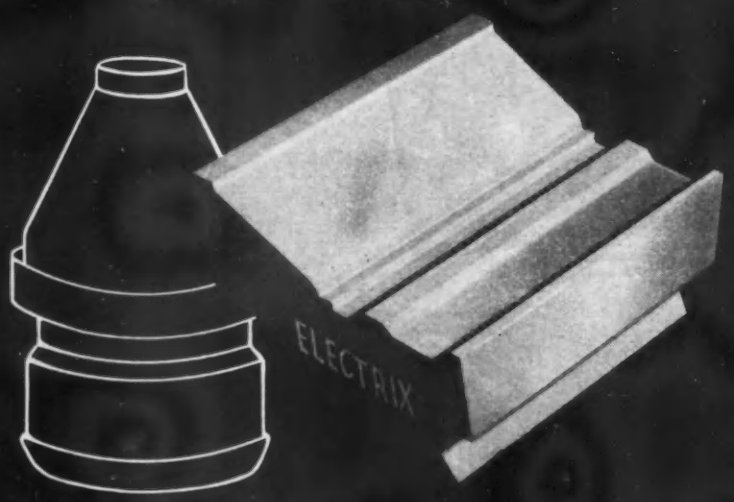
Form Tools



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ELECTRIX Corporation

Peacetime engineers of soft-rubber connectors for electrically-operated equipment, sold exclusively through U. S. RUBBER CO.

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Foxy shovel that loves a fight!

American engineering gave it a college education!

DIGS A FOXHOLE FASTER THAN A FOX! You dig fast—when bullets are flying! You burrow like a gopher. And you thank your lucky stars for the keen, tough blade of that handy little shovel. The sarge was right—it's a lifesaver!

PADDLE YOUR OWN CANOE! You'd want something different at Poughkeepsie. But this shovel is O.K. for paddling in the pinches. It's rust-proofed and won't reflect light. You dig it deep into the water . . . and heave-ho!

HOW DO YOU LIKE YOUR EGGS? It's no chef's delight but a foxhole shovel can double as a frying pan. Mighty handy for serving up hot beans, meat or eggs. The steel shank prevents the fire from burning the hard wood handle.

22 INCHES OF MAYHEM! At close quarters you can whip out your foxhole shovel. It's a killer! The blade's sharp and pointed. The cross bar handle won't slip in your hand. Yes, it's a foxy shovel that loves a fight!

We're just as proud of this foxhole shovel as we are of any of the items we're producing for war. Hundreds of thousands of them are being made by the Ingersoll Steel & Disc unit of Borg-Warner.

And the same standard of care and skill goes into their making as into the far more impressive looking war tools being made by us—amphibians, ammunition hoists, gun turrets and a hundred others.

With all these items, as in our peacetime products, a specialized knowledge and long experience with metals and production methods are clearly evident. They are produced under a guiding principle well known to you in the automotive and aviation industries who have done business with Borg-Warner—the principle "design it better—make it better".

The influence of this principle will continue to be felt in the days ahead through many products which we hope to build with you of the automotive and aviation industries.

Partners with the automotive and aviation industries in peace and war, Borg-Warner supplies these and other essential parts . . .

CLUTCHES AND CLUTCH PARTS GEARS
UNIVERSAL JOINTS AND DRIVE SHAFTS
TRANSMISSIONS CARBURETORS PUMPS
TIMING CHAINS RADIATORS
AVIATION STEEL

ENGINEERING B-W PRODUCTION

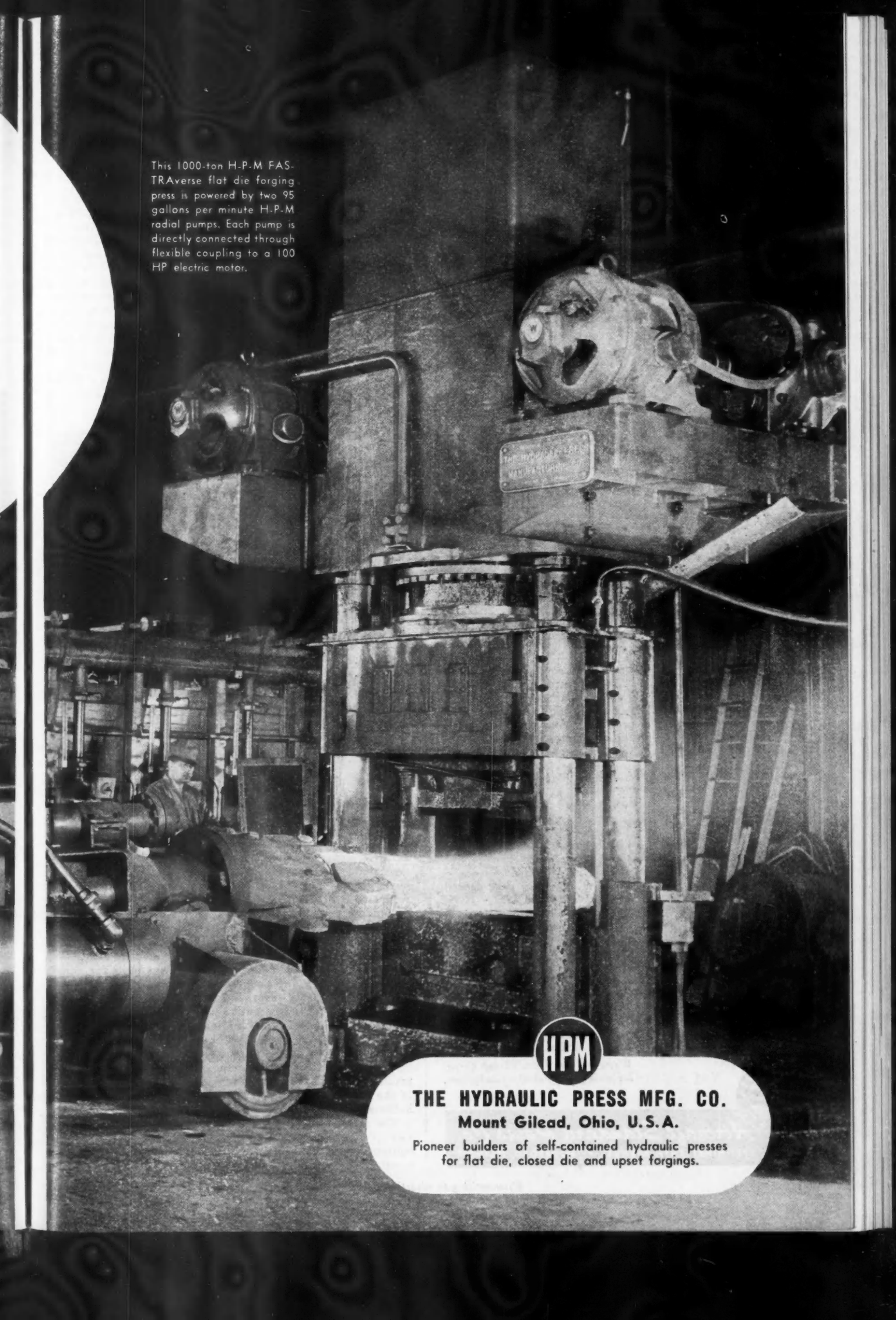
BORG-WARNER

Peacetime makers of essential operating parts for the automotive, aviation, marine and farm implement industries, and of Norge home appliances . . these units which form the Borg-Warner Corporation are today devoted exclusively to the needs of war: BORG & BECK • BORG-WARNER INTERNATIONAL • BORG-WARNER SERVICE PARTS • CALUMET STEEL • DETROIT GEAR AIRCRAFT PARTS • DETROIT VAPOR STOVE • INGERSOLL STEEL & DISC • LONG • MARBON • MARVEL-SCHEBLER CARBURETER • MCCULLOCH ENGINEERING • MECHANICS UNIVERSAL JOINT • MORSE CHAIN • NORGE • NORGE MACHINE PRODUCTS • PESCO PRODUCTS • ROCKFORD CLUTCH • SPRING DIVISION • WARNER AUTOMOTIVE PARTS • WARNER GEAR

TIMKEN STEEL IS FORGED with an H·P·M All-Hydraulic FASTRAVERSE PRESS

Timken's Steel & Tube Division employs an H-P-M FASTRAVERSE press for flat die forging. This revolutionary "All-Hydraulic" forging press has no steam boiler, accumulator or intensifier. H-P-M radial pumps are mounted overhead, near the press cylinder. This design permits an absolute minimum of piping. Oil is used as the hydraulic pressure medium, providing automatic lubrication. No operating valve is employed. The press is started, stopped, reversed and its speed changed by varying the stroke of the radial pumps by means of a single hand lever (remotely mounted). A fast stroke, plus a powerful squeeze, makes the H-P-M Forging Press the answer to modern forging problems. First costs are low, maintenance and operating costs far less than other types of forging equipment. Write today, stating your particular requirements.

A 6000 pound capacity auto floor type manipulator serves this 1000-ton H-P-M forging press installed in the plant of The Timken Roller Bearing Company, Canton, Ohio.



This 1000-ton H-P-M FAS-TRAverse flat die forging press is powered by two 95 gallons per minute H-P-M radial pumps. Each pump is directly connected through flexible coupling to a 100 HP electric motor.

HPM

THE HYDRAULIC PRESS MFG. CO.

Mount Gilead, Ohio, U.S.A.

Pioneer builders of self-contained hydraulic presses for flat die, closed die and upset forgings.

Look for

the name AIRCRAFT STANDARD PARTS CO. on "Aero-Seal" Hose Clamps. It appears on the wing of the thumb screw, and the housing is also stamped with the type number and "Aero-Seal". On the band and the wing you will find the part number and AN number.

AIRCRAFT Standard PARTS CO.

Originators of the

"Aero-Seal"

HOSE CLAMP

- HIGH STRENGTH
- UNIFORM PERIPHERAL TIGHTENING
- NO LEAKAGE UNDER HIGH PRESSURES
- SELF-LOCKING, NO LOCK WIRE NEEDED
- NO LOOSE PARTS
- CAN BE RE-USED
- CAN BE PUT ON HOSE IN PLACE
- WILL NOT DISTORT OR COLLAPSE THIN-WALL TUBING
- COMPACT DESIGN
- FULL RANGE OF SIZES
- EXTRA LONG TAKE-UP

Two years ago, at the request of Army Air Force authorities, we undertook the development of a new type hose clamp which would stand up under the strenuous vibration and pressure conditions of modern aircraft service. It took about a year of constant designing, testing, redesigning, and retesting before we finally evolved a model which would satisfy those requirements. Then came further knotty problems of tool design and the establishment of manufacturing methods to obtain volume production and assure maintenance of uniform high quality and dependability. The "Aero-Seal" HOSE CLAMP, as we finally perfected it, met and in many respects exceeded the stringent service demands as expressed in Army-Navy Specification AN-FF-C406a and Drawing AN748. Thus, when you see "Aero-Seal" Hose Clamps with the Aircraft Standard Parts Co. stamp on them, you can recognize them as the perfected product of our original design and development.

Write for our Hose Clamp Circular giving complete data and prices.

AIRCRAFT Standard PARTS CO.

Aircraft Standard Parts Co.

1717 NINETEENTH AVENUE • ROCKFORD, ILLINOIS

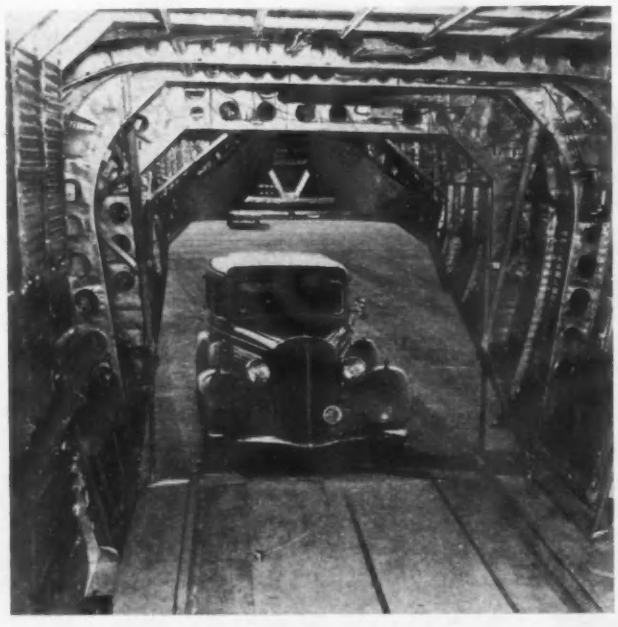
Welded Stainless Steel in Air Cargo Plane

(*Continued from page* 52)

out of the way to provide the necessary headroom to utilize the 8-ft square cross section of the cargo compartment.

The upward sweep of the afterbody of the plane provides a large clearance below the fuselage and back of the ramp to allow trucks to be moved close to the fuselage so as to pick up or discharge shipments. Provision is made for handling cargo with the aid of a specially-designed hoist fitted above the loading ramp, and a manually-operated winch mounted on the forward end of the cargo compartment. These permit the loading of large, heavy pieces of freight, machinery or motor transport. Both an ambulance and a jeep can be rolled into the cargo space at once and still leave a large space for stowage of other cargo.

The large cargo space is made possible through a unique design for the attachment of the wing to the fuselage. The

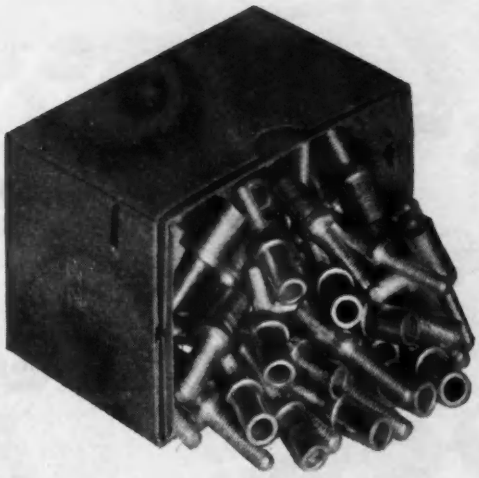


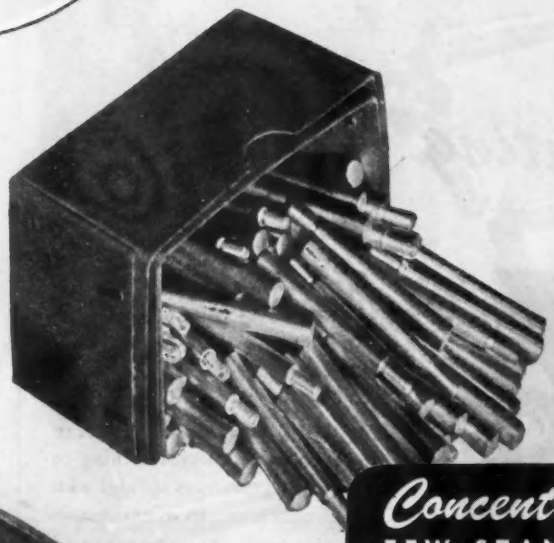
A unique design for the attachment of the wings allows headroom of eight feet.

wing structure does not pass through the fuselage in conventional fashion. Instead, Budd designers, through a novel arrangement of the fuselage. were able to attach the wings to five special side frames joined across the body by shalow, but rigid transverse members, thus providing headroom of 8 ft or 2½ ft more than that possible with conventional structure.

The new airplane plant and flying field near Bustleton where the planes are being assembled was built for Budd by the Defense Plant Corporation and is known as Budd Field. The property covers 557 acres. The assembly building itself is a huge structure 1800 ft long and 550 ft wide covering 24½ acres. The building was constructed largely of concrete to save critical steel, and has concrete arches of revolutionary design supporting the roofs. There are two assembly bays 122 ft wide and 64 ft high, and six manufacturing bays each 50 ft wide, all running the length of the building. Each of the assembly bays is designed to house a line of 26 planes in process of assembly.

The airfield adjoining the plant has two runways each 4400 ft long. Operations are directed from a control tower, equipped with the latest facilities and operated under the supervision of Civil Aeronautics Administration.





Concentrating ON A
FEW STANDARD ITEMS

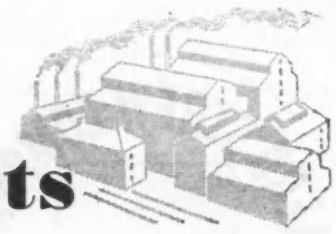
We have limited ourselves to the manufacture of a few standard items of AN Aircraft Hardware . . . in order to obtain concentrated attention, efficient manufacturing, and flexibility and fast action best obtainable with an organization of moderate size. Our products are: Hexagon and Drilled Head Bolts, Clevis Bolts and Pins, Rod Ends, Fillister Head Screws, Washers, Washer Head Screws, and Threaded Taper Pins. All of these are made to standard Army-Navy Specifications, of high quality materials, and using the best of modern manufacturing methods. Our latest Catalog No. 102 will give you full information, prices, and engineering data...write for your copy, and buy AEROSCREW products.

AEROSCREW

AERO SCREW COMPANY

19th AVE. at 12th ST., ROCKFORD, ILLINOIS

New Products



Sealing Compound for Porous Castings

Ault & Wiborg, Cincinnati, Ohio, are producing a synthetic resin for use with monomeric styrene in treating magnesium and other metal castings that have a tendency to be porous. The new resin, known as Ault & Wiborg No. 988 magnesium sealing compound-styrene soluble, is a 100 per cent non-volatile compound having a viscosity of Y-Z on the Gardner-Holdt scale.

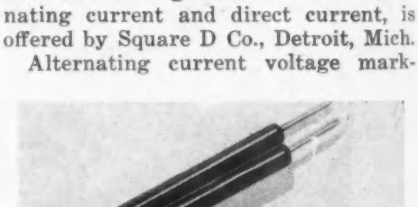
The usual mixing proportion is equal parts resin and styrene, though this depends somewhat on the porosity of the casting. An equal parts mixture gives a viscosity of approximately 35 centipoises. If the casting capillary openings are small, more styrene is used in the mixture—about 40 parts resin to 60 parts styrene. If they are large, the viscosity is increased by using a mixture of 60 parts resin to 40 parts styrene.

It is claimed this new resin has the property of cross-linking with the styrene molecule during polymerization without the aid of any catalyst. In fact, the impregnating solution is prepared by mixing the desired proportion of resin and stabilized monomeric styrene. Because of the cross-linkage between the two molecules, the co-polymer is gasoline insoluble.

New Type Voltage Tester

A voltage tester that tests without lamps, gives positive voltage identification and distinguishes between alternating current and direct current, is offered by Square D Co., Detroit, Mich.

Alternating current voltage markings are 110, 220, 440 and 550. Direct current markings are 125, 250, and 600. Frequencies can be determined by the vibrations of the indicator. The device is housed in a cylindrical fibre case, for easy gripping, and is practically unbreakable. The 4 in. fibre grips on the leads give complete insulation and leads are 24 in. flexible wire, with



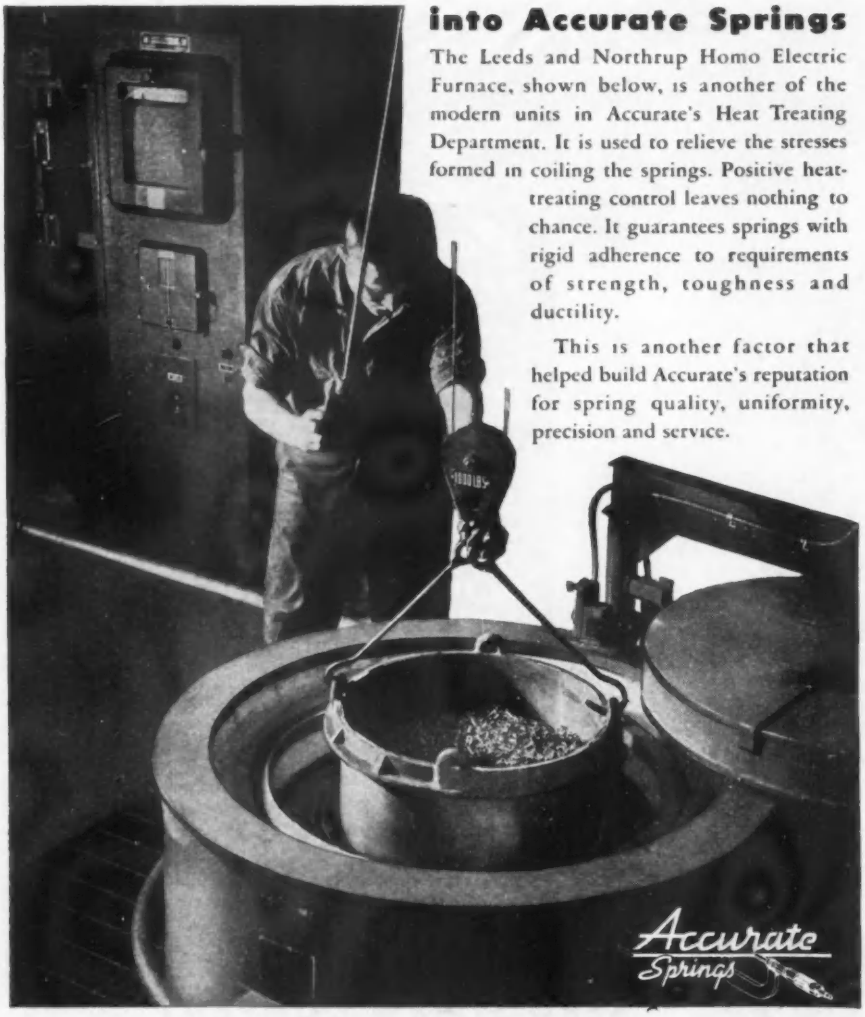
Square D voltage tester

Heat Treating Quality...

into Accurate Springs

The Leeds and Northrup Homo Electric Furnace, shown below, is another of the modern units in Accurate's Heat Treating Department. It is used to relieve the stresses formed in coiling the springs. Positive heat-treating control leaves nothing to chance. It guarantees springs with rigid adherence to requirements of strength, toughness and ductility.

This is another factor that helped build Accurate's reputation for spring quality, uniformity, precision and service.

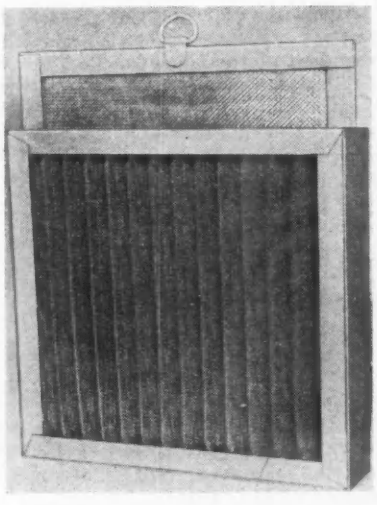


ACCURATE SPRING MFG. CO., 3811 W. Lake St., Chicago 24, Ill.

double thickness, rubber insulation vulcanized to the wire to prevent slipping. A peg and spring assembly prevent sharp bending and breaking of leads where they enter the case. Sharp spear points on the ends of the leads permit piercing of wire insulation for testing without damaging it.

Filter Removes Oil from Air

Oil thrown into the air during many industrial processes can often be eliminated through the use of an oil separator filter which has been placed on the market by Air-Maze Corporation, Cleveland, Ohio. This new filter, properly installed in a ventilating system, removes oil, kerosene, etc., from the air.



Air-Maze oil separator panel

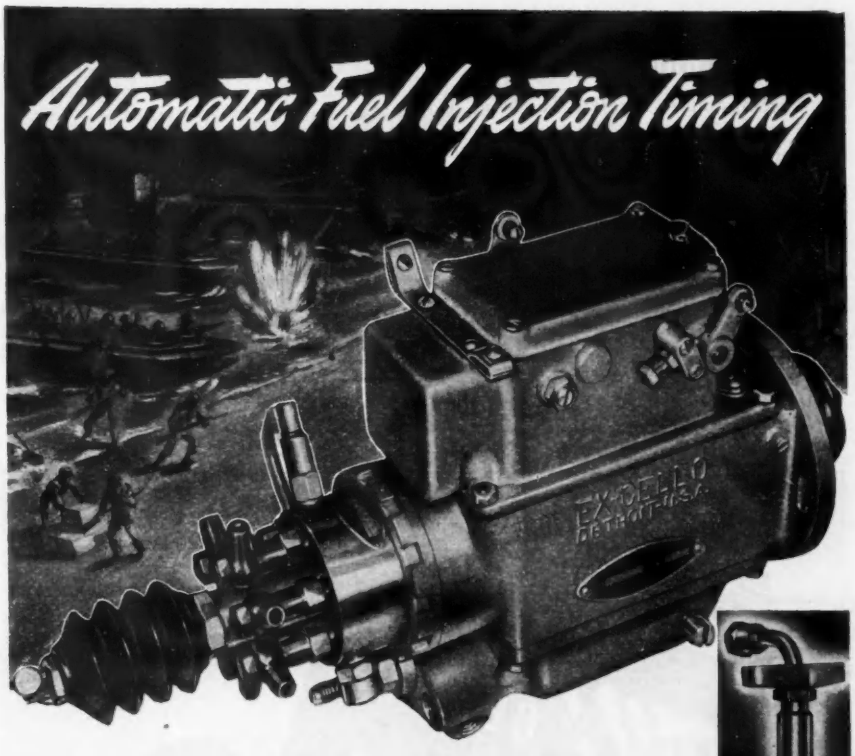
It does not, however, remove oil smoke or liquids in a true vaporous state. The unit consists of a permanent, viscous impingement filter that effectively removes dirt and dust from the air, and a removable oil collecting media that traps the remaining liquid particles. This oil separator panel is known as the Type R-56B, and is available in standard sizes.

New Chemical Makes GR-S More Workable

A chemical plasticizer to Make GR-S synthetic rubber behave more like natural rubber in the fabrication of tires, is a recent development of E. I. du Pont de Nemours and Company, Inc., Wilmington, Del.

One of the big differences between natural rubber and GR-S (familiarly known as Buna S type) is that the synthetic product is much more difficult to soften or plasticize by rubber mills and mixers prior to incorporation of the compounding ingredients. Natural rubber begins to soften as soon as it starts through the milling and mastication process. In the absence of the chemical plasticizer, the GR-S, however, will decrease tremendously in workability

(*Turn to page* 118, *please*)



This Ex-Cell-O Diesel Pump Feature Provides for Maximum Efficiency and Fuel Economy at All Engine Speeds

For variable speed applications such as Diesel-powered vehicles and motor ships, the automatic timing feature in the Ex-Cell-O type KB fuel injection pump provides for maximum power output and minimum fuel consumption by advancing fuel injection timing according to engine speed. Speed-responsive timing materially results in smooth, flexible operation throughout the operating range and increases the service life of vital engine parts. For applications not requiring automatic timing, the Ex-Cell-O type KD pump provides the same high degree of dependability and efficiency. Both of these war-proved pumps reflect Ex-Cell-O's quarter century of precision production and years of experience in the Diesel field.

The Ex-Cell-O nozzle is a worthy complement to Ex-Cell-O pumps, specifically designed for efficiency, dependability and trouble-free service.

For complete information, engine builders should address Diesel Division, Ex-Cell-O Corporation, Detroit 6, Michigan.

XLO
EX-CELL-O for PRECISION

EX-CELL-O
DIESEL FUEL INJECTION
EQUIPMENT
EX-CELL-O CORPORATION · DETROIT

Large Attendance at Westinghouse Forum

Westinghouse Electric & Mfg. Co. held its largest and most successful Machine Tool Electrification Forum on May 1 and 2 at Pittsburgh, where 380 executives and engineers from many of the machine tool companies throughout the nation joined with 130 representatives of Westinghouse and other companies to exchange ideas and experiences in that field. This 1944 meeting was the ninth annual event sponsored by the East Pittsburgh company.

During the two days 27 speakers addressed the sessions, which were devoted to machine tool engineering and business subjects. Discussions at the technical sessions centered primarily on machine tool electrification developments and problems, papers on which were presented by L. W. Scott Alter, president of the American Tool Works; E. E. Opel, National Automatic Tool Co., Inc.; D. K. Frost, Mattison Machine Works; E. J. Rivoira, Cincinnati Milling Machine Co.; R. H. Clark, Warner & Swasey Co.; G. A. Caldwell, Westinghoue engineer; and G. B. Carson, of the Cleveland Automatic Machine Co.

Another outstanding session was the symposium on the carbide milling of steel. The main paper was given by Dr. H. A. Frommelt, director of research, of the Kearney & Trecker Corp., followed by discussions on various phases of the subject by H. L. Pope, Cincinnati Milling Machine Co.; P. M. McKenna, Kennametal, Inc.; and B. P. Graves, of Brown & Sharpe Mfg. Co. A paper by E. O. Lowell, of the Grayson Mfg. Co., who was unable to attend, also was read. Recent research advancements in the processing and forming of materials were discussed by Dr. A. A. Bates, manager of the Westinghouse Chemical and Metallurgical Dept. E. L. Hemingway, chief metallurgist of the Foster Div., International Detrola Corp., gave a number of interesting observations on the galling of bearing surfaces.

Among the speakers on current and postwar business were J. Y. Scott, president of the National Machine Tool Builders Association; F. D. Newbury, Westinghouse vice president; Col. Willard T. Chevalier, publisher; and Frederick S. Blackall, Jr., president of The Taft-Peirce Mfg. Co.

Made of .025 cold-rolled steel. Rounded edge to prevent cutting hose. Extra strong .093 CR steel nut. Powerful, heat-treated SAE 1035 screw. *U. S. Patent No. 2339138.*

CHECK THESE FEATURES

1. **Immediate and positive clamping action.**
2. **Uniform circular clamping pressure.**
3. **Attached or detached without disconnecting the hose line.**
4. **Ample take-up even for synthetic hose.**
5. **Continuous band prevents leakage.**
6. **Welded flap prevents slippage.**

SEND FOR FREE SAMPLE of F-T-S Clamp. Be sure to give inside diameter of sample clamp desired.

CENTRAL EQUIPMENT CO.
900 SO. WABASH AVENUE CHICAGO 5, ILL.
Combat Vehicles, Farm Machinery, Diesel and Gasoline Engines, and All Types of Radiator Hose are Equipped and Serviced with Central Hose Clamps.

ACCA Formulates Airpower Policy, Elects Officers

Formulation of a permanent American airpower policy to safeguard national security and assure world peace and prosperity was urged by 15 presidents of leading aircraft companies, in session at Los Angeles.

Aircraft executives met for three days on problems of the newly reorganized Aeronautical Chamber of Commerce of America, the industry's permanent trade association devoted to long-range planning, and as the Aircraft War Production Councils, concentrating wholly on war problems.

American airpower, developed to dominant strength as an instrument of war, can be transformed into the leading instrument to preserve world peace, the presidents agreed.

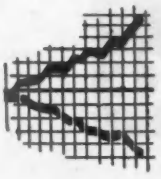
Recommended guiding principles for the policy were: (1) Maintenance of Army and Navy Air Forces "at such strength and in such state of readiness as to preclude a successful assault upon our country or its possessions." (2) Acquisition and maintenance of "air bases essential to our security and that of overseas trade." (3) Facilitating the "orderly and economic expansion of domestic and international air transport and private flying." (4) Preserving a "strong aircraft manufacturing industry."

Newly elected officers of the Aeronautical Chamber of Commerce of America are: Eugene E. Wilson (United Aircraft Corporation) Chairman of the Board; Donald W. Douglas (Douglas Aircraft Company, Inc.) Vice-chairman of the Board; James P.

(*Turn to page 66, please*)

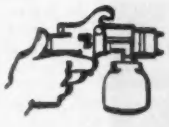
Here's why Nitrocellulose Lacquer is the finish to watch!

When you plan postwar finishes, just think of this: Nitrocellulose lacquer promises new possibilities. Don't overlook them—look them over!



Profits go up when costs go down, and the cost of finishing your product with nitrocellulose lacquer should be lowered by important changes now in process. Furthermore . . .

Higher solids content is the aim of extremely promising experimental work. By cutting down the number of coats required, this development will save time and labor, *further* reduce finishing costs. And, of course . . .



No drying equipment is needed, with its high initial cost, constant fuel and upkeep requirements, and inevitable depreciation. As always, nitrocellulose lacquers will *air-dry in minutes.* Their *color range* will be *unlimited.* They will still be tough, flexible, durable, resistant to water and chemicals. And above all, *easy and cheap to apply and repair!*

Write or call your lacquer supplier for specific aid on your finishing problems. Hercules makes no lacquers, but specializes on the manufacture of high-quality nitrocellulose and resins from which lacquers are made.

Continuous Research Pays Off

The Hercules Continuous Research Program is constantly at work for American Industry. It is continually finding *new* product improvements—*new* methods of handling, *new* end uses. *All* users of Hercules products share in the benefits of this research.

CELLULOSE PRODUCTS DEPARTMENT

HERCULES

CL-44

964 Market St.
Wilmington 99, Delaware

ACCA Formulates Airpower Policy

(*Continued from page* 64)

Murray (Boeing Aircraft Company) reelected President; Harrison Brand, Secretary; L. D. Bell (Bell Aircraft Corporation) Vice-president; LaMotte T. Cohu (Northrop Aircraft, Inc.) Vice-president.

The executive committee consists of: Eugene E. Wilson; Donald W. Douglas; Glenn L. Martin (Glenn L. Martin Co.); Ernest R. Breech (Bendix Aviation Corp.); P. G. Johnson (Boeing Aircraft Company).

The new Board of Governors of the ACCA is composed of the following: J. H. Kindelberger (North American Aviation Inc.); Robert E. Gross, President, Lockheed Aircraft Corporation; Harry Woodhead (Consolidated Vultee Aircraft Corp.); T. Claude Ryan (Ryan Aeronautical Company); Guy W. Vaughan (Curtiss-Wright Corporation); J. Carlton Ward, Jr. (Fairchild Engine & Airplane Corp.); Victor Emanuel (The Aviation Corporation); Alfred Marchev (Republic Aviation Corporation); R. E. Gillmor (Sperry Gyroscope Company, Inc.); Clayton J. Brukner (The Waco Aircraft Company).

30 YEARS' EXPERIENCE

in small MOTORS...

As the result of long experience we wish to emphasize this fact: that close cooperation between product manufacturer and motor builder right from the start results in these important advantages:

1. Correlation of product and motor design to provide a thoroughly integrated unit essential for top performance.
2. Frequently product design suggestions can be made that will not only reduce product weight but will improve compactness and appearance.

Our experience covering all types of special application fractional horsepower motors is available to your engineering department.

THE BLACK & DECKER ELECTRIC CO.
KENT, OHIO

THOROUGH ENGINEERING is the basic factor behind the successful operation of this aircraft fuel pump motor and many other special application motors we have designed for all types of equipment.

Black & Decker
SPECIAL APPLICATION FRACTIONAL HORSEPOWER MOTORS

ARMY E NAVY

Awards

Names and winners of Army-Navy "E" awards in or allied with the automotive and aviation industries, announced since the May 1 issue of AUTOMOTIVE AND AVIATION INDUSTRIES went to press:

ATLAS POWDER COMPANY, Atlas Works, Webb City, Mo.
CROWE NAME PLATE & MANUFACTURING CO., Chicago, Ill.
GENERAL MOTORS CORPORATION, General Motors Truck & Coach Div., Pontiac, Mich.
THE HAMLIN METAL PRODUCTS COMPANY, Akron, Ohio.
INTERNATIONAL CHAIN & MANUFACTURING COMPANY, York, Pa.
INTERNATIONAL STEEL COMPANY, Edgar St. Plant, Evansville, Ind.
LOCKHEED AIRCRAFT CORPORATION, Factory "B", Burbank, Cal.
LOVEJOY TOOL COMPANY, INC., Springfield, Vt.
MILWAUKEE FORGE AND MACHINE COMPANY, Milwaukee, Wis.
NICE BALL BEARING COMPANY, Plant No. 1, Philadelphia, Pa.
PARKER RUST PROOF COMPANY, Morenci Michigan Chemical Mfg. Plant, Morenci, Mich.
REPUBLIC AVIATION CORPORATION, Indiana Division, Evansville, Ind.
SIGNODE STEEL STRAPPING COMPANY, Chicago, Ill.
THE STUDEBAKER CORPORATION, Automotive Division, South Bend, Ind.
TORRINGTON COMPANY, Westfield Mfg. Co., Westfield, Mass.
UNITED SPECIALTIES COMPANY, Chicago, Ill.
S. B. WHISTLER & SONS, INC., S. B. Whistler & Sons Co., Buffalo, N. Y.

"E" Star Awards

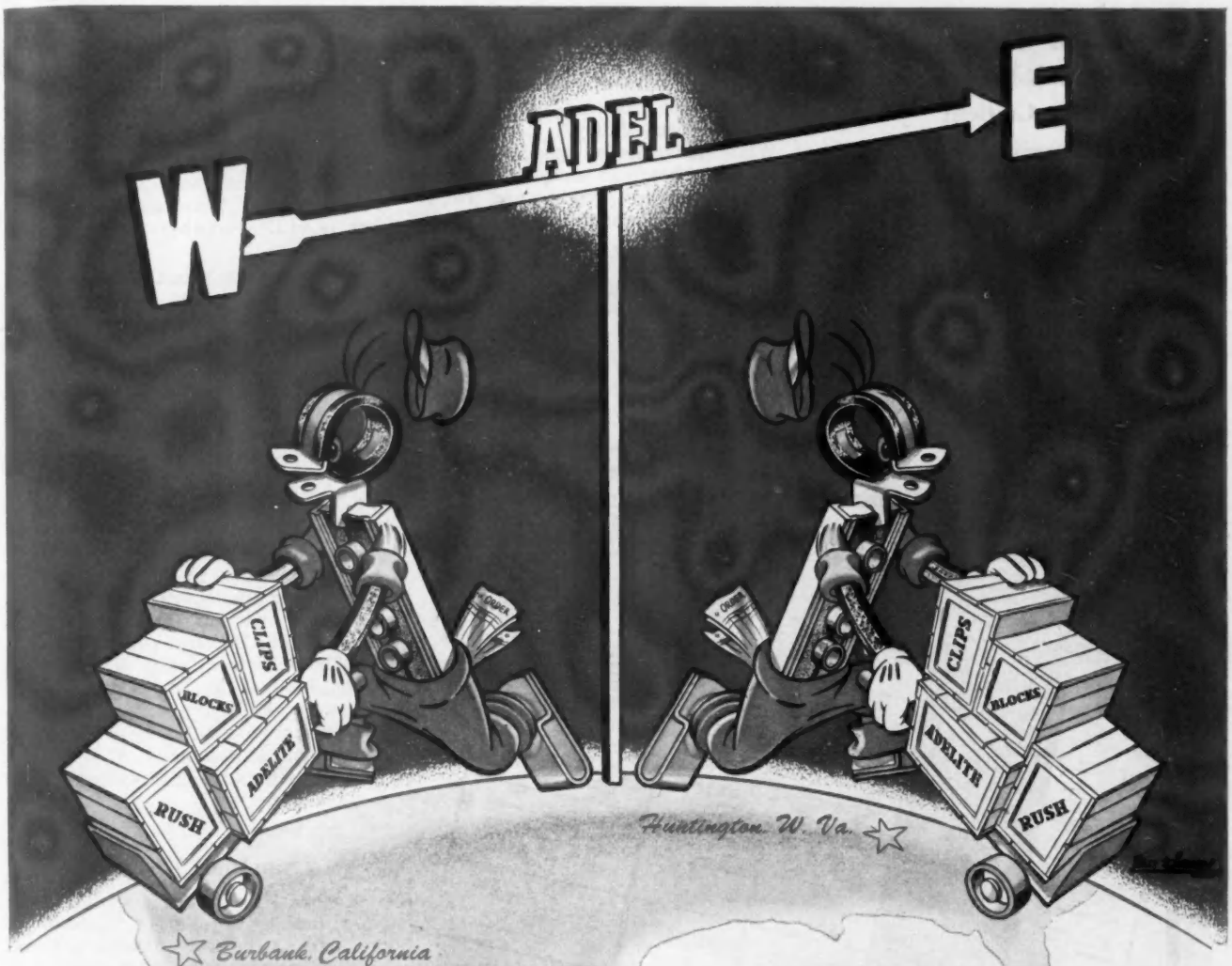
for continued meritorious services on the production front have been awarded to the following firms:

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa.
FEDERAL MOTOR TRUCK COMPANY, Detroit, Mich.
SPRAGUE ELECTRIC COMPANY.
MACK TRUCKS, INC., Plainfield, N. J.
MACK TRUCKS, INC., New Brunswick, N. J.
MACK TRUCKS, INC., Allentown, Pa.
ROCKFORD MACHINE TOOL CO., Rockford, Ill.
ALUMINUM INDUSTRIES, INC., Cincinnati, Ohio.
ARO EQUIPMENT CORPORATION, Bryan Plant, Bryan, Ohio.

Obituary

L. E. Phillips, 67, co-founder with his brother Frank Phillips of Phillips Petroleum Corp., died April 16 at Bartlesville, Okla. For many years he was vice-president and general manager of the company. He had been seriously ill since last summer.

William A. Rech, 48, personnel director of GMC Truck & Coach Division of General Motors Corp., died suddenly April 14 at Pontiac, Mich.



☆ Two Dependable Sources

Only ADEL offers two sources of line support clips and blocks—two plants with one high standard of quality. Duplicate tooling and production facilities under the same management and responsibility at Huntington, W. Va. and Burbank, Calif. to save shipping time and expense and render quicker service to both Eastern and Western customers. Many other reasons to specify ADEL: (1) Greatest variety (2) Service-tested quality (3) Competitive prices (4) Dependability of deliveries. Many types in stock ready for immediate shipment. For engineering recommendations on correct support of all fuel, oil, hydraulic lines and electric conduits see nearest engineering service office.

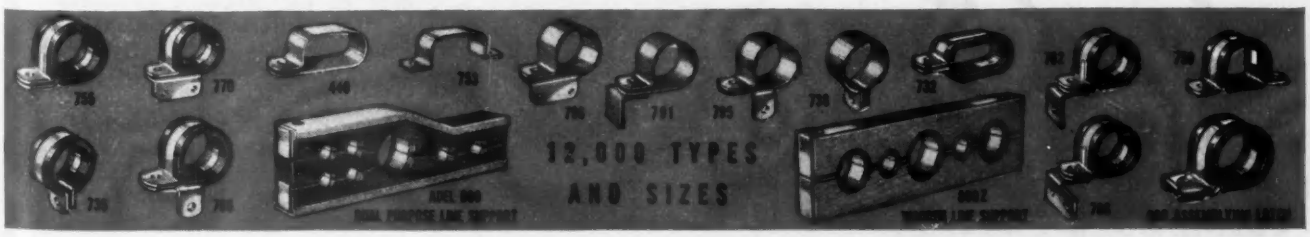
ADEL

PRECISION PRODUCTS CORP.

Burbank, California
Huntington, W. Va.

Engineering Service Offices: Seattle, Washington; Detroit Michigan; Hagerstown, Md.

FOR WAR (AND PEACE) BUY BONDS



Deliveries on Medium and Heavy Ball Bearings Continue Critical

Although deliveries of small ball bearings, including specialized aircraft bearings, have improved, deliveries on medium and heavy ball bearings (30 to 170 millimeters outside diameter) continue critical, according to a recent report of the Tools Division of the War Production Board.

The medium and heavy ball bearings are needed particularly in the Navy program, including landing craft, in the high-tenacity rayon and synthetic rubber programs and in the production of trucks and farm equipment. These bearings are produced principally in the Connecticut Valley.

While deliveries of specialized types of aircraft bearings such as airframe (control) bearings, engine and propeller bearings are much improved, bearings for starters, hydraullic pumps, voltage regulators and other aircraft accessories continue tight since they are in the 30 to 170 mm. category, the Tools Division said.

Other items in short supply are large roller bearings such as the large tapered and straight roller bearings needed for big lathes involved in the heavy artillery and ammunition programs and for marine propulsion equipment.

Spherical roller bearings are needed in the synthetic rubber program and for forging machines. The situation in straight roller bearings has improved, but is still somewhat tight for truck bearings.

From May, 1943, until February, 1944, the production of 30 to 170 mm. ball bearings was below net orders and an increasing backlog of unfilled orders resulted, the Tools Division said. Shipments exceeded net orders during February and March of this year, but this trend must continue in order to meet requirements since a substantial part of the backlog consists of orders for bearings which are past due and will be needed in the next few months.

The backlog of orders for 30 to 170 mm. ball bearings at the end of January of this year was approximately 78,000,000 units, or about 10 months' production at the January production rate, the Tools Division said. This backlog dropped to about 76,000,000 units at the end of February, and to about 73,000,000 units at the end of March, or eight months' production at the March rate. As stated above, only part of this is past due.

Sanford Resigns

A pioneer in the development of four wheel brakes, Roy Selden Sanford, vice president, Autoyre Co., Oakville, Conn., has resigned as consulting engineer of the Bendix-Westinghouse Automotive Air Brake Co., Elyria, Ohio, as of May 1. He became associated with Bendix interests in automotive brake developments in 1925, and more than 15 years ago was associated with the late Eddie Stinson in aircraft brake developments. He continues as consulting engineer of the Baird Machine Co., Bridgeport, Conn.

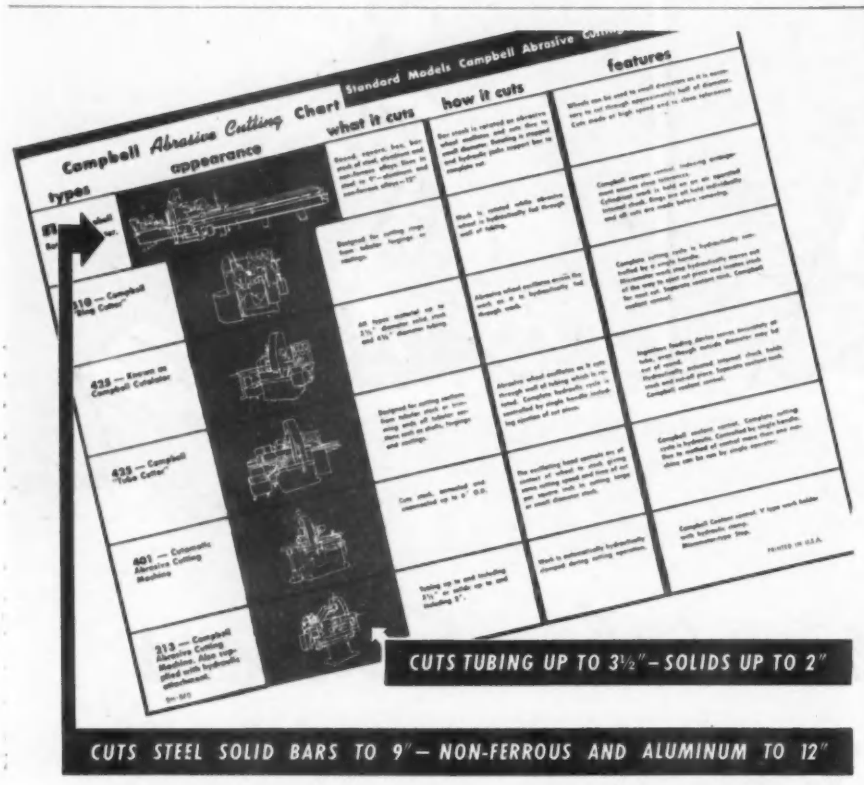
The first description of four wheel brakes as developed by Mr. Sanford and his associates in Bendix, appeared in AUTOMOTIVE INDUSTRIES in 1922.

Advertising Notes

Ernest R. Breech, president of Bendix Aviation Corporation, has announced the appointment of MacManus, John & Adams, Inc., of Detroit, as the corporation's advertising counsel.

Alfred P. Darcel of Crane Ltd., Montreal, has been appointed a vice-president of the National Industrial Advertisers Association, according to an announcement by NIAA president Frederic I. Lackens, The Hays Corporation, Michigan City, Ind.

John H. Sheldon has joined the copy department of the Geyer, Cornell & Newell, Inc., agency, it was announced by Vernon M. Welsh, vice-president and copy director.


Campbell Abrasive Cutting Chart
Standard Models Campbell Abrasive Cutting
types
appearance
what it cuts
how it cuts
features
CUTS TUBING UP TO 3½"—SOLIDS UP TO 2"
CUTS STEEL SOLID BARS TO 9"—NON-FERROUS AND ALUMINUM TO 12"

Ask a Campbell Engineer to suggest cutting procedure and figure costs for your cutting

CAMPBELL manufactures a complete range—in fact, the *only* complete range—of machines for abrasive cutting. 8 types, 19 models and countless variations developed to meet the jobs of cutting steels, annealed and unannealed; non-ferrous metals, plastics, glass and ceramics—solid bar, tubular and flat stock.

One corporation alone has found **CAMPBELLS** so efficient that they now use 120 **CAMPBELL CUTTING MACHINES.**

There is no reason why you should not call on this wide experience of **CAMPBELLS** and ask them what cutting procedure they would recommend for your plant—what the cost per piece would be. It doesn't put you under any obligation to do this but be sure to state materials you cut, shapes, lengths before cutting, lengths of cut-off pieces, production desired per hour.

Campbell

ABRASIVE CUTTING MACHINES

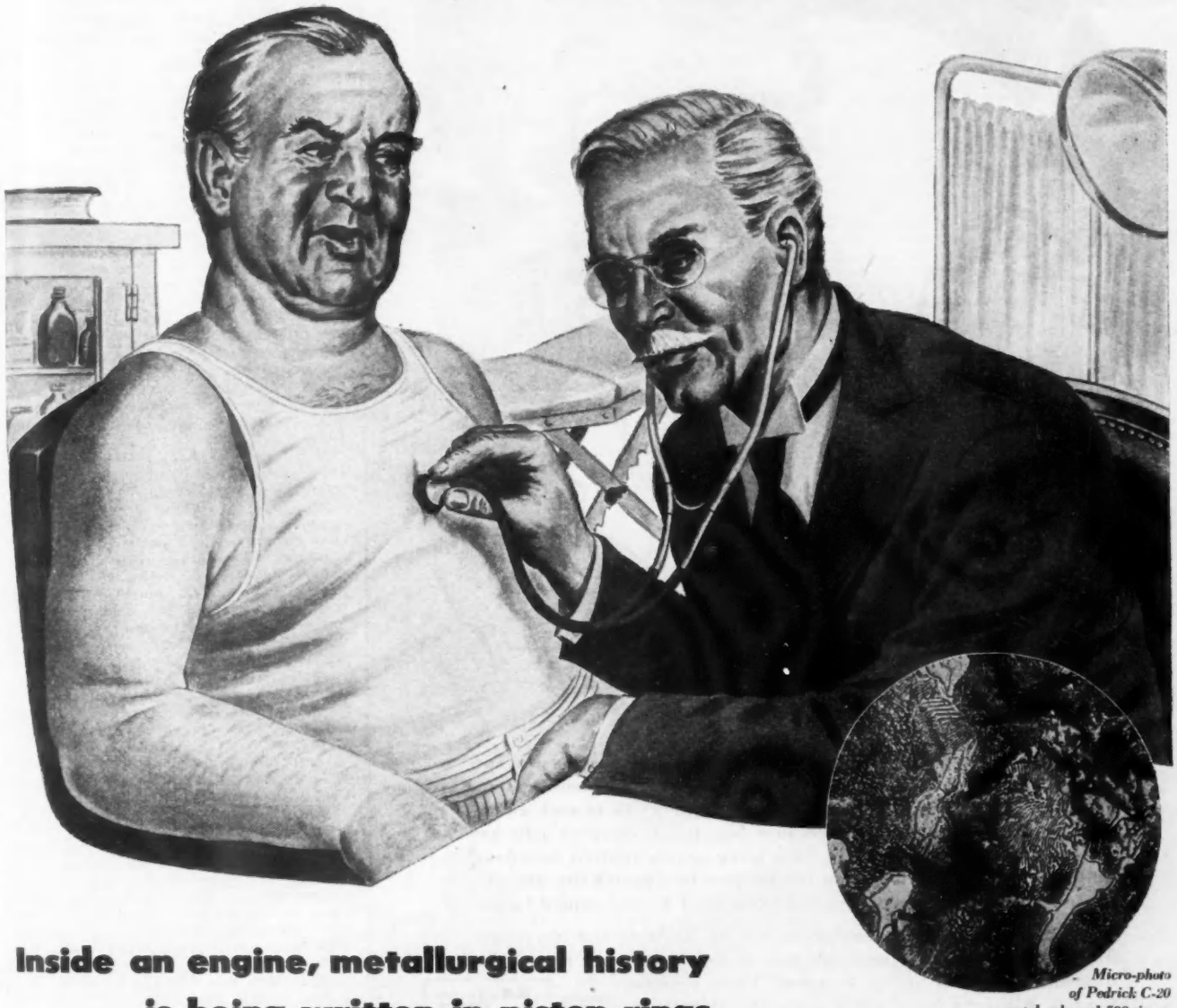
ANDREW C. CAMPBELL DIVISION · Bridgeport, Connecticut

ALSO MAKERS OF A COMPLETE LINE OF NIBBLING MACHINES

AMERICAN CHAIN & CABLE COMPANY, Inc.

BRIDGEPORT • CONNECTICUT

It's what goes on INSIDE *that counts*



Micro-photo of Pedrick C-20 metal enlarged 500 times.

Inside an engine, metallurgical history is being written in piston rings

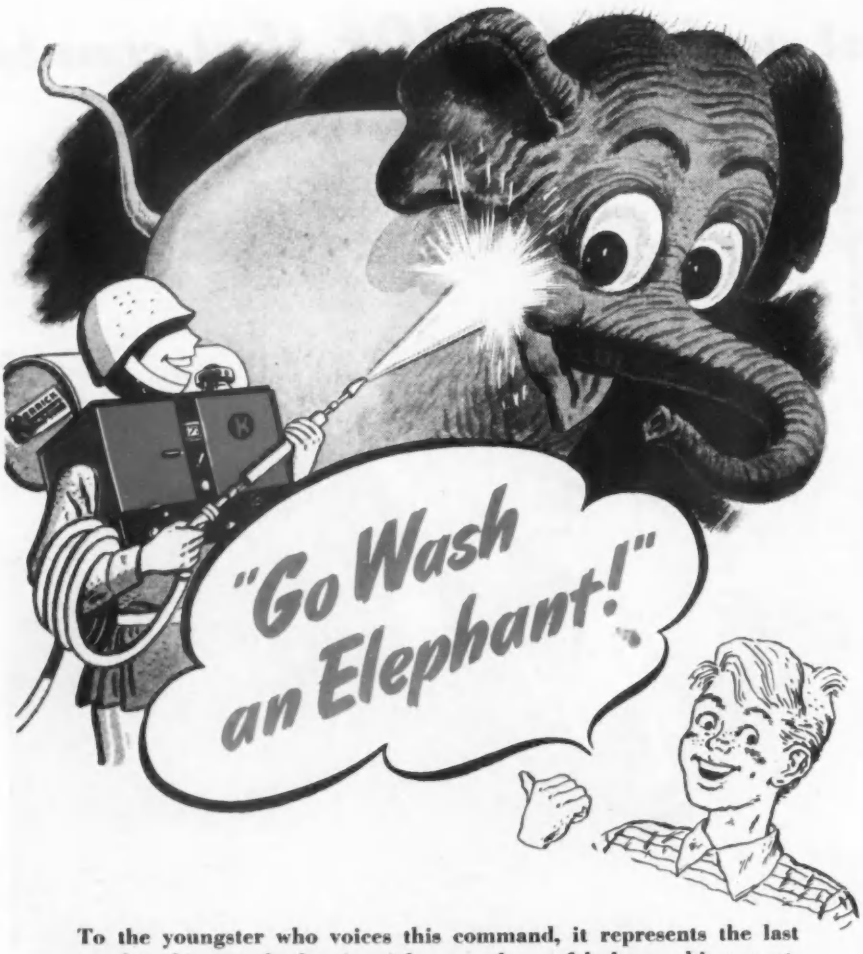
For some time now, the Pedrick piston rings we supply for United Nations aircraft engines have been made out of our new C-20 metal. No piston rings must meet a tougher test, for these engines power the world's fastest planes. Pedrick rings made of C-20 metal have more than twice the tensile strength of rings made of usual castings . . . and they are being used both with, and without, PORUS-KROME plating.

This is an example of the practical developments which war-production has created to assure even better piston ring performance in post-war operation. If you are concerned with any kind of engine, or compressor, or pump, or hydraulic equipment . . . wherever extreme pressures must be sealed or controlled . . . you'll find Pedrick *precisioneered* piston rings will deliver top efficiency. Wilkening Manufacturing Co., Philadelphia 42, Pa. *In Canada:* Wilkening Manufacturing Co. (Canada) Ltd., Toronto.

Pedrick

precisioneered **PISTON RINGS**

WAR BONDS IMPROVE WITH AGE . . .
HOLD ON TO THEM



To the youngster who voices this command, it represents the last word in *big*, tough cleaning jobs—an almost fabulous achievement. But if he knew about Kerrick Kleaners he wouldn't be in such awe of any cleaning assignment . . . because big, tough cleaning jobs are their daily diet. Kerrick Kleaners have accomplished dozens of difficult tasks, from laundering locomotives to cleaning the delicate, intricate parts of automatic range-finders used by our armed forces.

Both industry and the maintenance men of the Army and Navy have found that Kerrick Kleaners will save as much as 80 per cent of the time and manpower usually required. That's because Kerrick Kleaners meter out exactly the right combination of heat, detergent, water, and friction. Every day, Kerrick Kleaners are cutting the time and cost of removing grease and grime from war-torn military vehicles — cleaning airplanes, parts, machinery and complete factories.

After the war they will again be available for faster, cheaper and better automotive and industrial cleaning.

Illustrated is trailer-type Model L-OET

Other Clayton products helping the Armed Forces include Kerrick Cleaning Kompounds...Hydraulic Dynamometers... Flash Type Steam Generators... Feather-Touch Control Valves... Boring Bars and Holders.

CLAYTON MANUFACTURING CO.

ALHAMBRA CALIFORNIA

Business in Brief

***Written by the Guaranty Trust Co. New York, Exclusively for* AUTOMOTIVE AND AVIATION INDUSTRIES**

A renewed expansion of general business activity is indicated. The seasonally adjusted index of *The New York Times* for the week ended April 22 stood at 145.1, as compared with 141.6 for the preceding week, the peak of 150.3 recorded for the week ended January 29, and 138.0 a year ago.

Department store sales, as reported by the Federal Reserve Board, rose from 137 to 148 per cent of the 1935-39 average in the week ended April 22, but the value indicated was 11 per cent below the corresponding figure in 1943. For 1944 to date, the total is 4 per cent greater than the comparable sum last year.

Railway freight loadings during the week ended April 22 totaled 839,954 cars, 5.0 per cent more than the preceding weekly number and 5.8 per cent above the corresponding figure in 1943.

Production of electric power during the week ended April 29 declined slightly; but the total was 12.1 per cent above the output a year ago, as against a similar excess of 10.7 per cent shown a week earlier.

Crude oil production in the same period averaged 4,431,300 barrels daily, 3950 barrels above the figure for the preceding week, but 10,200 barrels less than the average recommended by the Petroleum Administration for War.

Estimated production of soft coal during the week ended April 22 was 12,250,000 net tons, 4.3 per cent more than the preceding weekly figure, as compared with 11,647,000 tons in the corresponding period last year. For 1944 to date, output is 2.6 per cent above the comparable amount in 1943.

Engineering construction contracts awarded during the week ended April 27 totaled $26,737,000, as against $51,425,000 for the week before, according to *Engineering News-Record*. Contracts so far reported in 1944 show a decline of 51 per cent from the corresponding amount in 1943—private projects registering a recession of only 1 per cent, while public construction has dropped 57 per cent.

The Irving Fisher index of wholesale commodity prices for the week ended April 28 registered a decline of one fractional point to 112.7 per cent of the 1926 average, as compared with 111.8 a year ago.

Member bank reserves declined $167,000,000 during the week ended April 26, and excess reserves dropped $300,000,000 to an estimated total of $600,000,000, the lowest level recorded since 1933 and first reached on March 29. Business loans of reporting members declined $82,000,000 in the same period but stood $219,000,000 above the total a year earlier.

Post-War Equipment Distribution in Spain

Harry Walker, president of the Harry Walker Sociedad Anonima, is the U. S. representative of the oldest garage and service station equipment firm in Spain. American manufacturers seeking distribution in Spain may contact Mr. Walker care of Bolton and Mitchell, Inc., 79 Wall St., New York, N. Y.

Speed Nuts*

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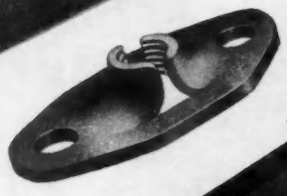
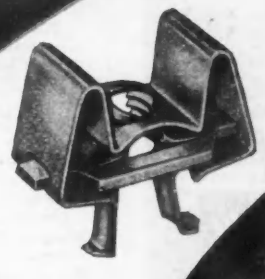
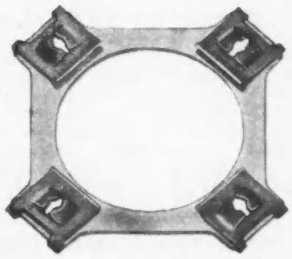
first in flexibility of design...







In addition to the many standard SPEED NUTS, there are hundreds of other shapes and types designed to perform multiple functions and combine several fasteners into one. These SPEED NUTS, wherever used, reduce the number of parts in an assembly and eliminate the unnecessary handling of extra parts.

The patented, self-locking SPEED NUT prongs can be incorporated into almost any shape or design to meet specific assembly requirements. No other fastener possesses such flexibility of design.

SPEED NUTS may be the answer to your assembly problem. We'll gladly review your specifications and recommend a standard or special SPEED NUT for your particular requirements.

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In Canada . . . Wallace Barnes Co., Ltd., Hamilton, Ontario

In England . . . Simmonds Aerocessories, Ltd., London

*Trademark Reg. U. S. Patent Office

★ *FASTEST THING IN FASTENERS*

PERSONALS

L. L. Duncan has retired as president of Midwest Aircraft Products, Inc., and has been succeeded by **M. M. Culver,** who was formerly vice-president in charge of engineering. **A. M. Fargo,** formerly secretary-treasurer, has been made vice-president in charge of sales.

John W. White has been elected president and general manager of the Westinghouse Electric International Co., subsidiary of Westinghouse Electric and Mfg. Co. **William E. Knox,** formerly assistant general manager, has been elected vice-president.

Joseph T. Ryerson & Son, Inc., has announced the following changes in its executive personnel. **Harold B. Ressler,** vice-president, formerly located in New York, is now in Chicago where he will be in general charge of sales in all territories. **A. Y. Sawyer,** assistant to the President, has been elected vice-president.

Fred H. Haggerson, vice-president and director, was elected president of Union Carbide and Carbon Corp. at a meeting of the board of directors. He succeeds **Benjamin O'Shea** who now becomes chairman of the board.

E. I. duPont deNemours & Co. has announced the appointment of **Harold Brayman** as director of the Public Relations Dept. He succeeds the late **Theodore G. Joslin.**

Zephyr Mfg. Co. has announced the appointment of **Robert G. Owen** as general manager.

Allegheny Ludlum Steel Corp. has announced the appointment of **R. H. Thielemann** as development engineer for the company and **Dr. Laurence C. Hicks** as metallurgical engineer and associate director of research in the Magnetic Products Div.

Gordon G. Johnson has been appointed plant manager of Lycoming Div. of The Aviation Corp. in Williamsport, Pa.

Armand J. Gariepy has been appointed contracts and service manager of Lawrence Aeronautical Corp.

The election of **Willard H. Cobb, George M. Tisdale, George P. Edmonds** and **Harry S. Lewis** as directors of United States Rubber Co. has been announced.

Godfrey Strelinger, formerly assistant to the general sales manager, Nash Motors Div., has been elected treasurer and assistant secretary of Nash-Kelvinator Corp.

Wyman-Gordon Co. has announced the election of **Harold F. Wood** as vice-president and general manager of Ingalls-Shepard Div., at Harvey, Illinois, and **Robert M. Powell** vice-president and general manager of sales, with headquarters at Detroit.

Electric Storage Battery Co. has announced the election of **C. F. Norberg** to the office of vice-president in charge of manufacturing and **D. N. Smith** to that of comptroller.

Eugene W. Wasielewski has been made chief engineer of McCulloch Engineering Corp. div. of Borg-Warner.

C. R. Beacham, formerly manager of the Chester, Pa., Branch, has been appointed southeastern regional manager of the Ford Motor Co. He succeeds **H. C. Doss,** who resigned recently. **J. Russell Gnau,** formerly assistant to C. E. Sorensen, will be associated with John W. Thompson in supervision of the public relations dept.

Allen L. Struble, formerly sales manager, has been elected vice-president in charge of sales of Trailer Co. of America.

Henry Ford II, executive vice-president of Ford Motor Co., has been elected a director of Ford Motor Co. of Canada, Ltd., succeeding his father, the late Edsel Ford.

Robert F. Black, president of White Motor Co., has been elected a director of Pennsylvania Central Airlines.

Horace A. Davies, treasurer of Chrysler Corp., has been elected to a three-year term as a director of the Detroit Board of Commerce.

Thomas Flood has been appointed original equipment sales manager of Electric Auto-Lite Co.

A. J. Porta, formerly chief accountant, has been elected assistant controller of the Studebaker Corp.

Arthur B. Lawrence and **C. L. Beatty** have been elected to vacancies on the board of directors of Campbell, Wyant & Cannon Foundry Co.

Charles E. Wilson, president of General Motors Corp.; **Henry Ford II,** executive vice-president of Ford Motor Co.; **E. R. Breech,** president of Bendix Aviation Corp.; **O. E. Hunt,** executive vice-president of GM; **E. C. Kanzler,** board chairman of Universal C. I. T. Credit Corp., and **A. M. Wibel,** vice-president of Nash-Kelvinator Corp., have been elected directors of the Economic Club of Detroit.

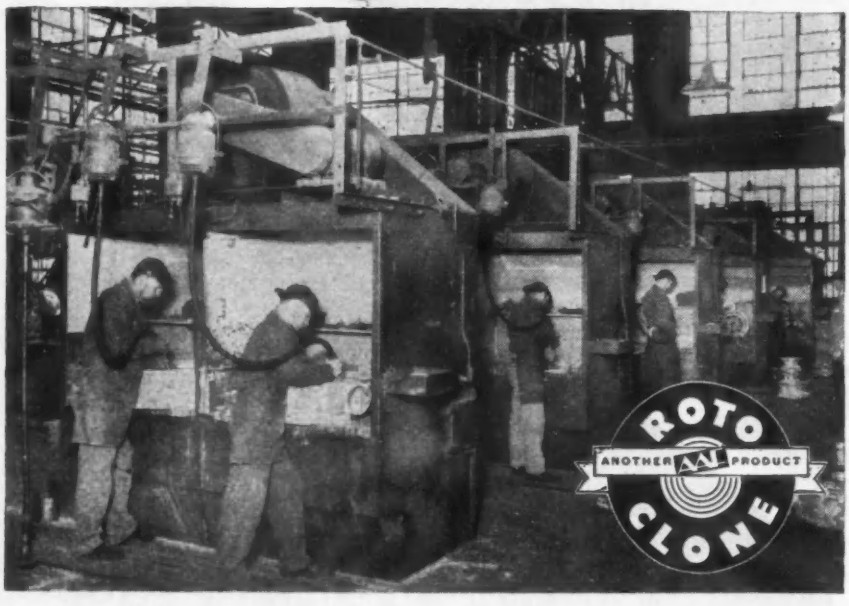
Members of the newly appointed Outboard Motor Industry Advisory Committee of WPB are **H. Biersach,** Evinrude Motors Division of Outboard Marine & Mfg. Co.; **J. F. Furry,** Gale Products Division of Outboard Marine & Mfg. Co.; **A. C. Kieckhafer,** Hartford (Wis.) Division of West Bend Aluminum Co.; **E. A. Longenecker,** Lauson Division of Hart-Carter Co., New Holstein, Wis.; **C. E. Scott,** Scott-Atwater Mfg. Co., Minneapolis; **W. W. Spurgeon,** Muncie Gear Co., and **P. A. Tanner,** Johnson Motors Division of Outboard Marine & Mfg. Co.

Alfred B. Bennet has been appointed director of post-war sales of Aeronca Aircraft Corp.

William Davey, formerly general manager of the Airplane Division Buffalo plants of Curtiss-Wright Corp., has been named assistant works manager of the Niagara Frontier Division of Bell Aircraft Corp.

Howard L. Hartman has joined the Chance Vought Aircraft Division of United Aircraft Corp. as executive assistant.

Safe MAGNESIUM DUST Control



If the dust is dangerous or explosive such as magnesium dust the AAF Type N ROTO-CLONE is the answer to your problem!

The Type N is available as shown as complete self contained booth-benches for grinding, buffing and polishing, or in large sizes for serving a central dust exhaust system. Type N collection is safe because precipitation is under liquid and the unit contains no restrictions, ledges or recesses where dust can collect. If you have a magnesium or other dust problem write us for bulletins describing the AAF equipment suited to your needs.

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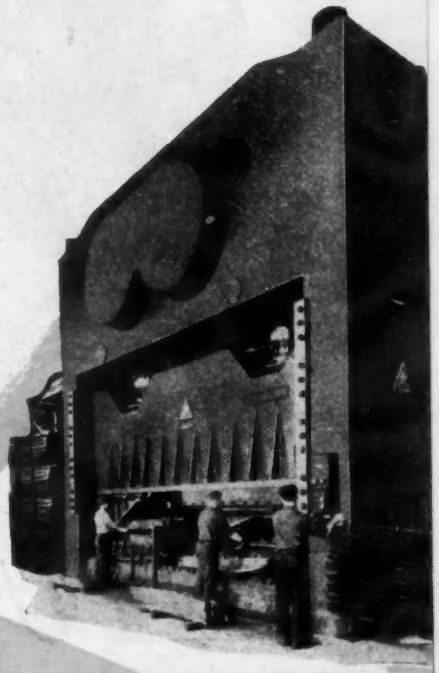
AMERICAN AIR FILTER COMPANY, INC., 449 CENTRAL AVE, LOUISVILLE, KY.
IN CANADA: DARLING BROTHERS, LIMITED, MONTREAL, P. Q.

HE KNEW HOW, BUT NOT WHY

Ages ago, a man sat at the potter's wheel and pondered the mystery before him. At the touch of his hands the yielding clay took graceful, symmetric form. The mystery, of course, was the circle . . . that geometrically precise figure that lies in one plane, with all points of its circumference equidistant from its center.

If the mystery of the circle had never been solved, if man had never learned the rules of mathematics that must guide his design, we might still be pondering at the potter's wheel.

Today, with knowledge and initiative, men have gained amazing successes in countless fields of endeavor. In our field, for example, Clearing has combined sound engineering and initiative to produce outstanding presses of every type and capacity. If you have a problem in production where a press can or might do the job, we invite you to call on Clearing. Clearing Machine Corporation, 6499 West 65th Street, Chicago 38, Illinois.



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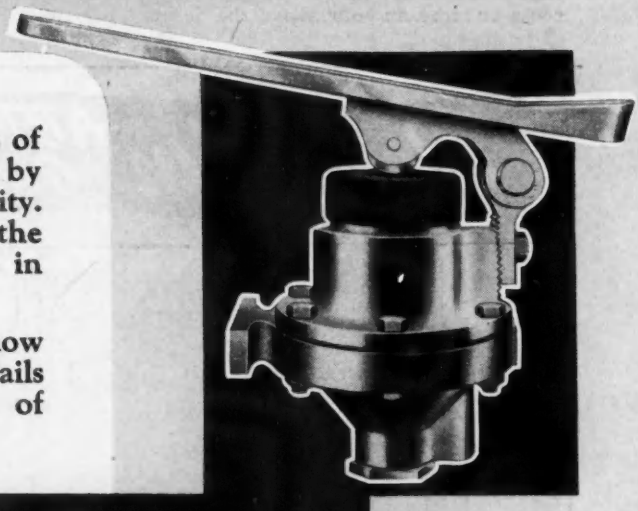
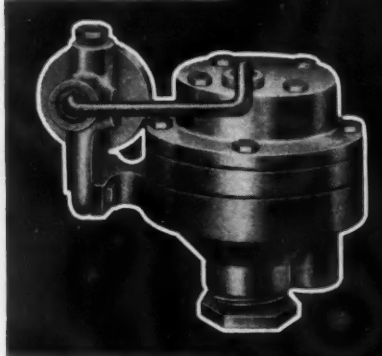
s are blazing new trails in POWER CONTROLS

UNDER the rigorous, exacting requirements of military aircraft, power controls developed by AAC engineers have proven their superiority. In all the theaters of war, from Alaska to the African deserts, they have set new records in performance and dependability.

With the background of this war-tested "know how", AAC engineers are now blazing new trails in the development of many other types of engineered power controls—hydraulic, air, vacuum and electric. Tomorrow's trucks, trailers and buses . . . marine craft . . . Diesel and gas engines . . . airplanes . . . industrial machinery and equipment . . . will be equipped with these controls, to make operations easier, safer, more efficient and more economical.

AAC engineers are at your service, to help you with your own power controls problems now or after the war. Just ask for an AAC POWER CONTROLS ENGINEER. And write for further information concerning our new air brake equipment and other AAC *engineered power controls.*





{Above} Treadle Type Air Brake Valve.

{Left} Relay Emergency Air Brake Valve.

{Below} Finger-tip Trailer Brake Control.

POWER CONTROLS DIVISION

BURBANK, CALIF.

(P-64)

T ACCESSORIES CORPORATION

ER CONTROLS • PRECISION RADIO *and* ELECTRONICS

ork N. Y. Kansas City, Kans. Cable Address: AACPRO

UAW-CIO Setback in Stabilization Effort

(*Continued from page 48*)

rather than the Detroit wage scale. However, the board did permit payment of the tank arsenal rates at other Chrysler plants in the Detroit area under certain conditions.

In another Detroit case, three strikes have beset two plants of Republic Aircraft Products Division of Aviation Corp. within a month despite the fact that wage scales at the plants are 10 cents or more an hour above the going rate for comparable jobs in the Detroit area. Twelve hundred employes defied the regional WLB and their own UAW-CIO international union officers in carrying the latest strike into its eighth day. The latest walkout occurred when a union steward and another employe were discharged and 35 other workers were given disciplinary 5-day layoffs for refusal to do work assigned to them. However, dissatisfaction has been prevalent at the plant since the employes went from piecework to straight rates with a resultant cut of 20 to 30 cents per hour. The piecework rates permitted too high hourly earnings and created high labor costs. As a result the Army Air Forces demanded lower unit prices and the wage issue was arbitrated. In an effort to end the latest strike, the AAF ordered the discharge of two strikers and the suspension of five others. The international union also announced that it was withdrawing all union protection from the strikers and would punish the ringleaders to the full extent of the union's constitution.

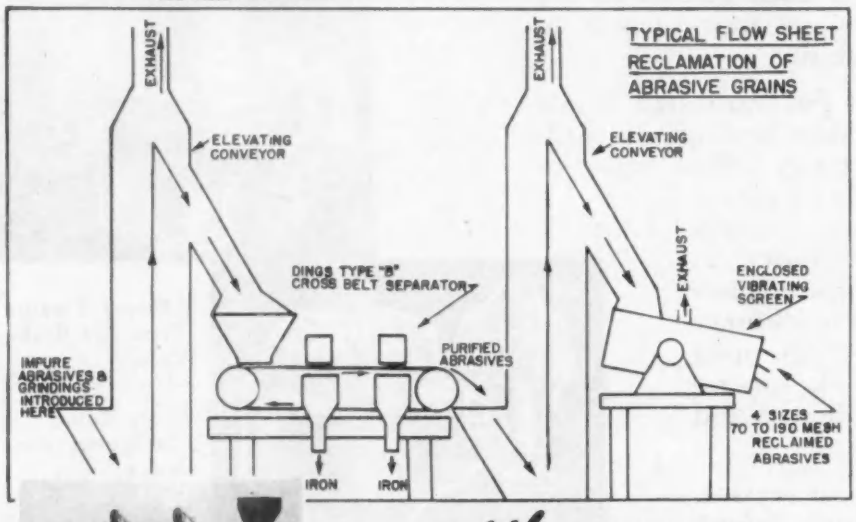
War production at 11 Detroit plants was crippled when there was a recurrence of the dispute between the Foremen's Association of America and the management at Briggs, Hudson, Murray Corp. and Packard. Walkout of 1000 foremen at five Briggs plants over failure to adjust grievances was followed by strikes at the other plants, evidently in a concerted move to force recognition of the FAA by the companies. Although an NLRB decision of May 11, 1943 in the Maryland Drydock case established that a foreman's group is not a proper collective bargaining unit, the FAA has pressed its claims since that time with several walkouts. The Ford Rouge and Murray Corp. Ecorse plants were scenes of brief walkouts last summer and the Ford Willow Run plant was similarly affected last December. In the present strike, W. L. Davis, chairman of WLB, notified Robert H. Keys, president of FAA, to have the men return to work pending an imminent decision by the NLRB on whether the discharge of a foreman constitutes an unfair labor practice under the Wagner Act.

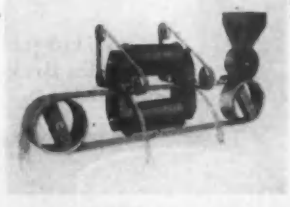
Keys, who organized the FAA in 1941 at the Ford Rouge plant and now claims a membership of 25,000 in 81 chapters, mostly in the Detroit area, cited three reasons for the strikes. He said the National Association of Manufacturers was determined to break the foremen's union, government agencies refused to accord foremen any avenue for grievances and that companies were taking advantage of this situation during the war to deny foremen their human rights and privileges.

"They see sweepers enjoying rights of collective bargaining which they, the foremen, do not enjoy," asserted Keys. "They see men under their jurisdiction making much more money than they do, because foremen may work long hours but get no overtime. The men see discrimination by employers increasing, no avenue for negotiation and WLB complaisance." The Maryland Drydock case "leaves us neither fish nor fowl," said Keys. We are identified with management but have no voice in maangement policies. We are employes but have no way to speak for ourselves as employes."

Frank Rising, general manager of the Automotive & Aviation Parts Manufacturers, Inc., gave management's view of the situation recently before the Society for the Advancement of Management in Chicago. "Foremen's unions will continue to ex-

Reclaim ABRASIVE GRAINS with DINGS CROSS BELT SEPARATORS





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Material to be purified is carried on a belt under a series of highly intensified magnetic zones. Magnetic material is attracted upward to the under surface of the cross belts which carry it to the side beyond the magnetic influence, where it is discharged. Non-magnetic material is discharged at the end of the main belt.

The intensity of each magnetic zone can be controlled independently so that materials of varying magnetic susceptibilities can be separated from each other. These units can be built with as many zones and cross belts as desired.

THAT abrasive grains can be practically and profitably reclaimed has been demonstrated by a number of large plants using Dings Magnetic Separators.

The flow sheet illustrated is being used by a middle-western plant which is reclaiming approximately 1500 lbs. of grain per day. Sweepings are collected from both rough and finish grinding operations and are found to average approximately 15% iron and 85% abrasive. The reclaimed grain is mixed with virgin grain, in a ratio of 1/3 reclaimed to 2/3 new, to make rough grinding wheels only. These have been found entirely satisfactory, comparing favorably with those using all new abrasive. The entire installation paid for itself in a relatively short time.

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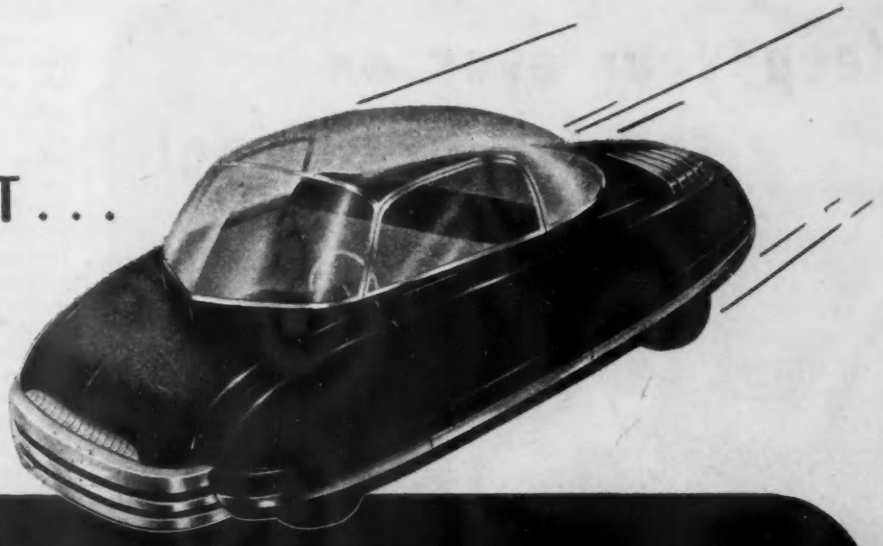
I PREDICT . . .



by George W. Walker

Industrial Designer of Detroit

"The car you will own, in what engineers call the *post* post-war period, will take greater advantage of streamlining for beauty and efficiency. Running boards will disappear, permitting wider bodies and more seating room. There will be foam rubber upholstery, soundproofing, opaque colored plastic panels and plexiglass windshields and tops that will provide greater visibility and safety. The small car sketched here is designed with the engine in the rear and enclosed running gear, permitting an extremely short turning radius. The car your War Bonds will buy will be fully air-conditioned, making window ventilation unnecessary and eliminating the present-day annoyance of draughts, rain and dust."

* * *

Note: The Weatherhead Company, one of the oldest and most important manufacturers of parts for the automotive industry, is prepared for the day when its four plants will again be contributing to the country's peacetime automotive needs.

FREE: *Write on company letterhead for "Seeds Of Industry"—a history of The Weatherhead Company, its many facilities and diversified products.*

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Keep your eyes on the job of seeing!

Proportion LIGHT TO NEEDS OF each WORKER'S TASK

In your plant, as in every plant, seeing needs vary with different operations. Good lighting on one task is poor lighting on a more critical task. Efficient work requires the right lighting — the right "seeing" tool — for each and every operation.

Balanced lighting answers this problem. It proportions lighting to the individual seeing needs of each worker — provides the quantity and quality of illumination his particular work requires for the maximum in production speed and accuracy.

Fostoria Industrial Service Centers, located in major cities, will make a fundamental study of light for seeing in your plant without obligation. As industrial lighting specialists serving thousands of plants, they are properly equipped and qualified to solve your lighting problems.

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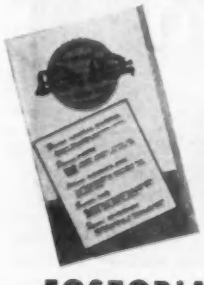

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NEMA

ist, even though not recognized as bargaining groups," said Rising, "and will continue to gain converts as long as the war-time boom conditions and manpower demand produce peak wages which make salaried men envious. When hourly rated take-home wages decline, the advantages of the salaried job will again become apparent. I believe that the foremen's unions will never be recognized by NLRB under the present national understanding of the foremen's place in the management structure. If they are recognized and succeed in becoming bargaining agents, I would expect them to become affiliated in due course with the production unions. From that point on neither management nor union leaders would have faith in the foremen's ability to steer an unbiased course in industrial relations. If this ever occurs, another layer of management would have to be built up to handle the first steps in grievance procedure and to interpret management policy. This would mean only that a new class of foremen under another name had been trained and that the unionized foremen then could return to the ranks."

GM Shipments of War Materials

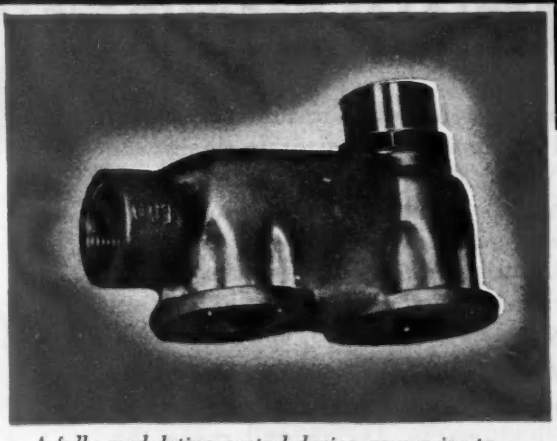
General Motors' shipments of war materials in the first quarter of 1944 gained only 2.6 per cent over the fourth quarter of 1943, indicating a leveling off of war output. First quarter shipments totaled $1,048,456,985, which was 37 per cent greater than the first quarter of 1943, however, when deliveries were $765,525,835. GM war deliveries are now at a rate of $12,000,000 daily or $4 billion per year.

CALENDAR

Conventions and Meetings

SAE Natl. Diesel-Fuels & Lubricants Meeting, Chicago	May 17-18
SAE Natl. War-Materiel Meeting, Detroit	June 5-7
Automotive Engine Rebuilders Assoc., Cincinnati	June 13-15
American Society for Testing Materials (47th Annual Meeting), New York City	June 26-30
SAE Natl. Transportation & Maintenance Meeting, Philadelphia	June 28-29
SAE Natl. West Coast Transportation & Maintenance Meeting, Portland, Oregon	August 24-25
SAE Natl. Tractor Meeting, Milwaukee	Sept. 13-15
SAE Natl. Aircraft Eng. & Production Mtg., Los Angeles	Oct. 5-7
SAE Natl. Fuels & Lubricants Mtg., Tulsa	Nov. 9-10
American Chemical Society Natl. Chemical Exp., Chicago	Nov. 15-19
SAE Natl. Air Cargo Mtg., Chicago,	Dec. 4-6
SAE Annual Meeting, Detroit	Jan. 8-12

THAT EXTRA 10 M.P.H.



A fully modulating control device, responsive to both temperature and pressure. Protects oil cooler from damage by high-pressure surges, and controls oil temperatures.

IN AERIAL COMBAT an extra 10 M.P.H. is often the difference between victory or a sudden intimate acquaintance with a parachute. For peak performance, engines simply *must* be correctly lubricated . . . there's no place for cold-sluggish or heat-thinned oil when the chips are down.

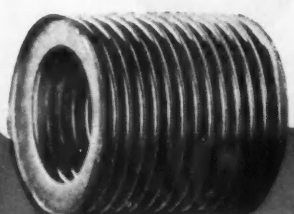
By holding circulating engine-oil temperatures within narrow limits, a Fulton Sylphon Control Device "flattens" the oil viscosity curve, automatically maintaining correct motor lubrication, even under the most exacting conditions.

Fulton Sylphon products are essential parts in thousands of aircraft engines . . . *automatically* regulating pressures and temperatures . . . helping to put an extra 10 M.P.H. into the throttle. Write for Bulletin KB-822, which describes the latest developments in Fulton Aircraft Instruments.

ARMY (E) NAVY

FULTON SYLPHON

TEMPERATURE CONTROLS



BELLOWS . . . BELLOWS ASSEMBLIES

THE FULTON SYLPHON CO., KNOXVILLE 4, TENNESSEE

Sheet Mills Hard Pressed To Meet Demand

(*Continued from page* 46)

does, solely from a desire to leave nothing undone to speed the winning of the war, is obviously best arrested by immobilizing all such excess capacity in the manner followed by WPB in the case of these two units.

While the latest news from Bolivia regarding the tin mining situation in that turbulent republic is disquieting politically, bringing the information that one of the wealthiest mine owners has been arrested and charged with being the leader in a plot to overthrow the existing government, New York tin trade specialists say there is absolutely no ground for uneasiness regarding the position of the United States in the matter of tin supplies. It is stated on good authority that, even if Bolivia should not ship us another pound of tin concentrates in the next twelve months, we would not suffer. Our stockpile of tin is quite reassuring and the Belgian Congo is sending steadily growing tonnages here. The Bolivians have been sulking ever since their efforts to get more money for their tin have failed.

Supplying the Missing Link

AMERICAN RESOURCES!

● Acadia Synthetic Products, working hand in hand with aircraft designers and manufacturers, is compounding synthetic rubber *to build into it the special qualities needed for the particular service it is to see.* Compounds have been developed at Acadia to meet Army, Navy and A.M.S. specifications.

Let Acadia engineers go over your requirements with you, and explain our qualifications to design and make the exact synthetic part or product you may need. Write us today.

RING GEARS

BUSHINGS

CHANNELINGS

GROMMETS

GASKETS

ACADIA Synthetic PRODUCTS

Processors of Synthetic Rubber and Plastics • Sheets • Extrusions • Molded Parts

DIVISION WESTERN FELT WORKS

LARGEST INDEPENDENT MANUFACTURERS AND CUTTERS OF FELT

4035-4117 Ogden Avenue Chicago 23, Illinois • Branch Offices in All Principal Cities

PUBLICATIONS

The Linde Air Products Co. has published a manual on basic oxy-acetylene welding and cutting procedures. It is titled **The Oxy-Acetylene Handbook,** is priced at $1.50 per copy and can be obtained by writing The Linde Air Products Co., 30 East 42nd Street, New York, N. Y.

The Bristol Co. has announced a new bulletin, No. B220, describing its new line of **Free-Vane Electronic Controllers** for automatically controlling temperature, pressure, liquid level and humidity. It gives wiring diagrams, principle of operation and general description and feature of new instruments.*

Fischer & Porter has issued a new catalog, No. 93-B, giving its complete line of **Bull's Eye Sight Flow Indicators.** Information on sizes, dimensions, types of connections, etc., to simplify specification, are included.*

American Phenolic Corp. has issued a new booklet, **OK Methods,** which gives result tested work procedures based upon extensive experience in the manufacture and assembly of AN connectors.*

A new bulletin has been issued by the Empire Electric Brake Co., describing in detail the operation of its **Vacdraulic Brake Power Booster.** It illustrates the operating principle and the mechanism of the Vacdraulic Brake Power Booster.*

The Hydraulic Press Mfg. Co. has issued a new booklet, **The H-P-M Closed Circuit Fastraverse System of Press Operation.** It describes and illustrates the details of the closed circuit system.*

Arens Controls, Inc., has published a new bulletin on **grommets.** The bulletin offers design and production engineers complete information on models available, specifications, applications and exclusive features of **Dura-Grom,** designed and developed by Arens engineers.*

Willard Storage Battery Co. has issued a new special Lines Catalog which illustrates and describes **Willard Aircraft, Charge-retaining, Marine, Stationary and Radio storage batteries.***

The Acadia Synthetic Products Div of Western Felt Works has issued a 70-page book on **synthetic rubber.** The book contains many photographs, comparable tables and numerous charted tests of such effects as freeze resistance, hardness, heat, fuel resistance, aging, etc. Technical data includes extrusions molded parts, sheets, rolls and cut parts.*

Simmonds Products Fly With Famous Planes, is the title of a publication describing Simmonds automatic engine control, precision push-pull control, hydraulic fuse and the chronometric radiosonde.*

A new general tool catalog GT-175 has been issued by Carboloy Co. Prices and specifications are listed for such Carboloy products as **masonry drills, diamond-impregnated grinding wheel dressers** and **center grinding cones, etc.***

The National Smelting Co. has issued a 16-page booklet called **RED-X Aluminum Alloys.** The booklet is designed to present information about the quality, acceptance and use of Red-X Alloys and their advantages for a wide variety of applications.*

General Electric Co. has issued a new booklet on **Pyranol Transformers.** It is well illustrated with photographs and charts showing various installations.*

A new, revised pamphlet, **Stellite Star J-Metal Cutting Tools,** has been issued by Haynes Stellite Co. Detailed information is given on tool holders and adaptors that can be made for use with Star J-Metal; the sizes, prices and descriptions of "Stellite" alloy wear strips are also given.*

* Obtainable by subscribers within the United States through Editorial Dept. AUTOMOTIVE *and* AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

2000°
1800°
1600°
1400°
1200°

HIGH TEMPERATURES

...as they affect the properties and usefulness of metals

A metal's fitness for high temperature use is usually measured by two yardsticks:

1. *Its resistance to oxidation*
2. *Its strength and hardness*

at the temperatures it must undergo.

Getting a good rating on one of the two counts isn't enough. A thoroughly satisfactory metal for most heat-resisting use must get a high mark on both.

Resistance to oxidation is measured in terms of freedom from scaling and intercrystalline attack. High strength won't matter for long if a metal oxidizes and scales, thus reducing in cross-section, or if intercrystalline change saps its vitality. Also, in many applications, the scale that flakes off is one more complicating factor.

On the other hand, an oxidation-resistant metal that is too soft or weak to support its required load in the high temperature range is out from the start.

Strength for heat-resisting service is measured by a series of tests, the most important of which is the creep strength of the material.

In this test, the metal is subjected to known stress under controlled temperature and atmosphere conditions. The results are reported as pounds of stress necessary to produce an elongation over a prolonged period of time.

Along with this basic test for high temperature usefulness are others which determine the endurance limit, impact strength, short-time tensile strength, and hot hardness . . . all of which help give a "yes" or "no" to the metal's selection for high temperature use.

The results of these tests in the chart below show the reasons for the remarkable high-temperature service life of the nickel-chromium alloy Inconel.

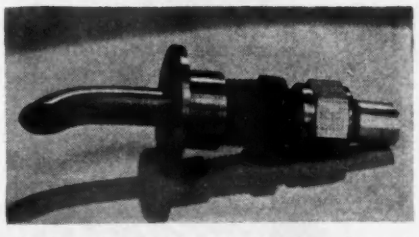
For most purposes . . . and especially for applications where mechanical stress is involved...Inconel is outstanding even among the heat-resisting INCO Nickel Alloys for service at the highest temperatures. Inconel fights off progressive oxidation. It is little affected by thermal shock, or sudden, wide swings in temperature. It holds up well under both suddenly applied and constant load and it is a workable material which can be formed into complicated shapes and welded to produce ductile joints that endure constant vibration without cracking.

An aeronautical use that points up some of the properties of Inconel is the collector tube on the fuel-air mixture indicator for bombers and fighters. Continuously exposed as it is to the direct blast of corrosive exhaust gases at 1400° F., the tube must combine freedom from oxidation with strength at high temperatures. No other material has been found which does this particular job as well as Inconel.

The many heat-resisting properties of Inconel are demonstrated, perhaps even more graphically, by the exhaust manifolds used on Pan American Clippers.

A collector ring for a Pan American Clipper must be able to withstand temperatures ranging from a normal 1500° F. up to white heat on take-offs—far above the temperatures where most metals would weaken, warp and scale away. The hot strength of Inconel is its chief value as a material for exhaust manifolds.

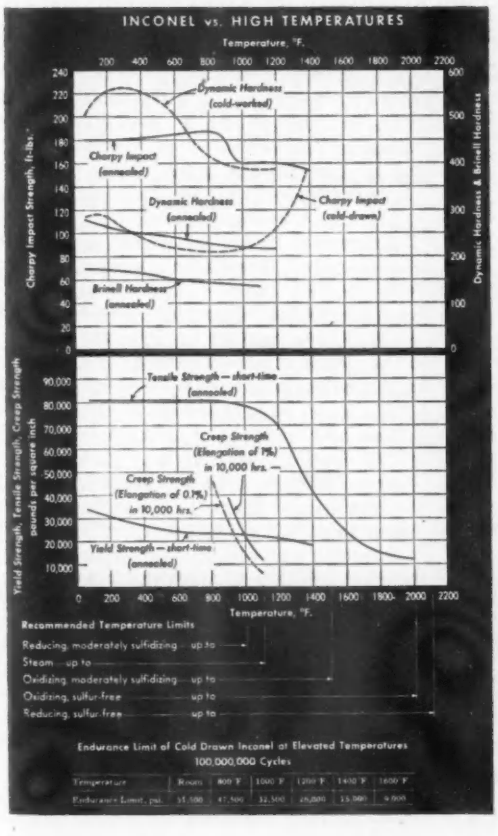
Here, the same red-hot blast of exhaust gas is encountered as in the collector tube. Intense vibration and exceedingly quick temperature changes are piled on top of the corrosive and strength-sapping attack of the hot gas. Despite these destructive factors . . . and the very light gauge of the sheet used . . . many of the Inconel manifolds have seen more than 5000 hours of flying service *without repair.*



Continuously exposed to aircraft exhaust fumes at around 1400° F., this collector tube for a fuel mixture indicator is made of strong, heat-resistant Inconel. Tube is product of Cambridge Instrument Co., New York, N. Y.

For further information regarding the properties and working of INCO Nickel Alloys, write for a copy of the new booklet "INCO Nickel Alloys for the Aircraft Industry." A copy is yours for the asking.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 WALL STREET NEW YORK 5, N. Y.


INCONEL vs. HIGH TEMPERATURES
Temperature, °F.
Dynamic Hardness (cold-worked)
Charpy Impact (annealed)
Dynamic Hardness (annealed)
Charpy Impact (cold-drawn)
Brinell Hardness (annealed)
Charpy Impact Strength, ft-lbs.
Dynamic Hardness & Brinell Hardness
Tensile Strength — short-time (annealed)
Creep Strength (Elongation of 1%) in 10,000 hrs.
Creep Strength (Elongation of 0.1%) in 10,000 hrs.
Yield Strength — short-time (annealed)
Yield Strength, Tensile Strength, Creep Strength pounds per square inch
Temperature, °F.
Recommended Temperature Limits
Reducing, moderately sulfidizing — up to
Steam — up to
Oxidizing, moderately sulfidizing — up to
Oxidizing, sulfur-free — up to
Reducing, sulfur-free — up to
Endurance Limit of Cold Drawn Inconel at Elevated Temperatures
100,000,000 Cycles
Temperature
Endurance Limit, psi.

nothing up his sleeve

• No "magic wands" or "cure-alls" are at the command of the Stuart service engineer. For a wand he uses the fund of engineering experience developed by D. A. Stuart Oil Co. over 79 years in the business. Instead of cure-alls, he offers top quality cutting fluids engineered to job requirements. With these simple tools he has achieved results in metal-working far more useful than the best that magic can boast. With your cooperation, we feel confident that he can do the same for you.

Our free booklet called "The 577th Oil" gets down to cases. Write for your copy.

Studebaker Military Truck Production

(*Continued from page* 28)

It will be noted from the foregoing that the major operations adapt conventional and advanced passenger car procedures for the fabrication of cabs, chassis, motor assembly, and other units.

The pictorial section, showing views along the final assembly line, will enable the reader to visualize the progressive stages of the assembly process. At the end of the final line, the trucks are driven off under their own power and are ready for testing on the rolls. Following the adjustments made at this stage, the trucks received their road test under Army supervision.

Since practically the entire output of the assembly line is intended for immediate shipment overseas, upon completion of the road test the vehicles are delivered to the "Tear-Down" building for dis-assembly and export packing. This procedure is similar in other truck plants where vehicles are produced for overseas duty. Here the trucks are moved on a mechanized conveyor line and completely torn down in accordance with a systematically developed procedure. It may be observed that the workers on this line must have even higher skills than those who make the initial assembly.

Unlike the situation in plants producing heavier duty vehicles, the Studebaker line possesses complete interchangeability of units and parts, making unnecessary the conventional methods of matching and marking parts for the same vehicle. Naturally this speeds up dis-assembly and packing as well.

The company is particularly proud of its export parts packing department. The secret of its efficient operation lies in the introduction of mass production techniques and the elimination of considerable manual handling through the adoption of conveyor lines, materials handling devices, and mechanized equipment. Cleaning and rust-proofing formerly performed by hand now are done automatically as the loaded parts baskets follow dips in an overhead conveyor system. Hardening of rust-proofing liquids is also designed into the automatic routine.

Wrapping, waxing and packaging of parts follows after baskets have been transferred from the overhead to a conveyor belt. The belt carries baskets through inspection and into a large room where girl packagers are seated at tables extending at right angles to the conveyor. In the manner of continuous flow assembly, the parts move from one team of four girls to another, taking on the treatment specified by key-numbered shipping tags.

For processing, loaded baskets pass through a washer-dryer oven to re-

(*Turn to page* 86, *please*)

In 1928 Chicago Rawhide began manufacturing the "Perfect" Oil Seal to seal shafts within and protruding from mechanisms of various kinds. Since then Chicago Rawhide engineers have studied this one problem continuously in all of its many aspects in the shop, in the laboratory and in the field.

Naturally, in all that time these engineers have built up a body of data far more detailed and comprehensive than any machinery manufacturer could afford to build. But there is no reason why this data and experience should not be used by any machine builder.

Chicago Rawhide engineers are ready to apply what they have learned to what you are designing. Post-war competition will capitalize quality.

CHICAGO RAWHIDE MANUFACTURING CO.

1310 ELSTON AVENUE • CHICAGO, ILLINOIS

PHILADELPHIA • CLEVELAND • NEW YORK
DETROIT • BOSTON • PITTSBURGH • CINCINNATI

65 Years Manufacturing Quality Mechanical Leather Goods Exclusively and now Sirvene Synthetic Products

Then he said to himself

"THIS WAR HOLDS UNPREDICTABLE DEVELOPMENTS"

FOR once Premier Mussolini was right when, just a year ago, he warned the Fascist Directorate that "This war still holds unpredictable developments, which will not all be on the political plane."

But there was enough on the "political plane" to slam his chin back in his collar, and if one wishes to read a moral into his statement, it could well be:

You always lead with your chin when you team up with the wrong working partner.

It is then you get unpredictable results of a DESTRUCTIVE nature.

When writing to advertisers please mention AUTOMOTIVE *and* AVIATION INDUSTRIES

"Unpredictable Developments" he says

Look, Benito (wherever you're in hiding), how men achieve predictable developments of a CONSTRUCTIVE nature when through recourse to Lincoln, they team up with a CONSTRUCTIVE partner. For example:

LINCOLN'S NEW AIRCRAFT WELDING COMBINATION

PREDICTABLE DEVELOPMENTS: (1) The "Shield-Arc Jr." Aircraft Welder with famous Dual Continuous Control providing the right TYPE of arc and the right AMPERAGE for every job. (2) The convenient, light-weight, foot-operated "Lincontrol". (3) "Planeweld" Electrode for chrome-moly steels. (4) "Fleetweld" Electrode for mild steel.

CONSTRUCTIVE RESULTS: (1) "Tailor-made" welding arc to suit the job. (2) Accurate control of arc intensity without interruption to welding; less operator fatigue. (3) Best possible welds at highest welding speed and lowest cost . . . on every job . . . all the time.

Write for details on this New Lincoln Aircraft Welding Combination.

THE LINCOLN ELECTRIC COMPANY • CLEVELAND 1, OHIO

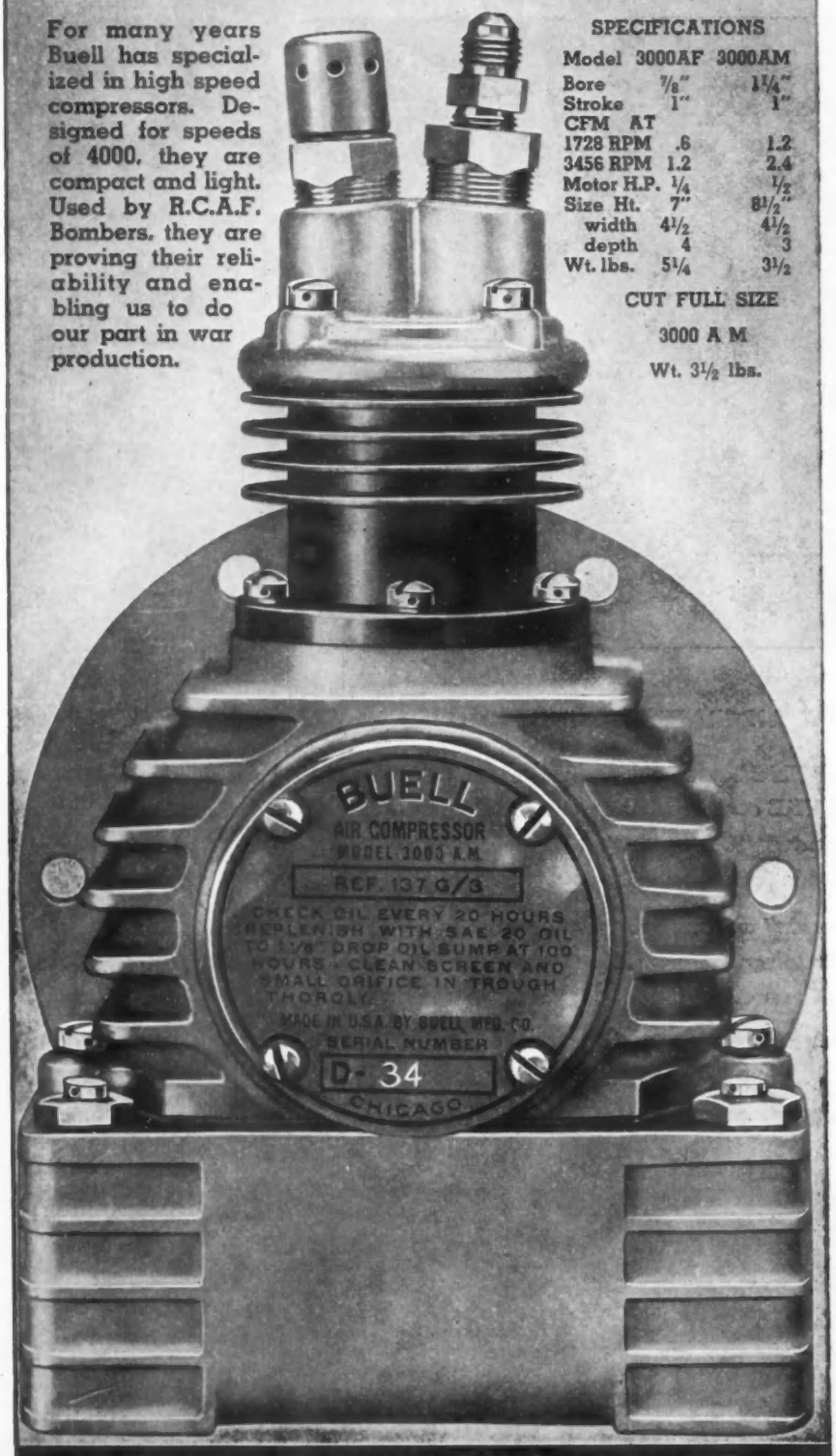
America's greatest natural **recourse**

ARC WELDING

BUELL . . . AIR COMPRESSOR

A precision built product with high alloy forged steel crankshaft, hardened and ground to close tolerances.

For many years Buell has specialized in high speed compressors. Designed for speeds of 4000, they are compact and light. Used by R.C.A.F. Bombers, they are proving their reliability and enabling us to do our part in war production.



SPECIFICATIONS		
Model	3000AF	3000AM
Bore	7/8"	1 1/4"
Stroke	1"	1"
CFM AT		
1728 RPM	.6	1.2
3456 RPM	1.2	2.4
Motor H.P.	1/4	1/2
Size Ht.	7"	8 1/2"
width	4 1/2	4 1/2
depth	4	3
Wt. lbs.	5 1/4	3 1/2

CUT FULL SIZE

3000 A M

Wt. 3 1/2 lbs.

BUELL MANUFACTURING CO.

Dept. AA, 2975 COTTAGE GROVE AVE., CHICAGO, ILL.

(*Continued from page* 82)

move dirt and grease. From the oven the baskets are hooked on a moving overhead conveyor which dips them first through a tank containing fingerprint remover and later through a tank for rust-proofing. The baskets next travel through an oven held at 150 F. to bake the rust-proof liquid into a protective coating.

"Mold wrapping" is the most unusual of practices of the packing room and was evolved by the Army to give added protection to parts subjected to widely varied climates in the battle areas. Using wooden mallets, the packers press "no-oxide" paper into the crevices of gear teeth, sealing them against atmospheric corrosion. Many of the parts are then waxed, dipped, cartoned, and the carton dipped before final wrapping. Wax dipping is done by hand, immersing each end of the part in a vat containing wax heated to 170 F.

The text has been supplemented with a group of illustrations taken in various parts of the plant to provide an overall picture of the interesting operations.

Bending Time Reduced By Induction Heating

(*Continued from page* 21)

There are several possible methods of eliminating the gradient. An obvious attack lies in the redesign of the induction coil. It is also practicable to apply a lower frequency alternating potential difference to the coil, perhaps as low as several hundred cycles per second. The depth of penetration for such a low frequency would be of the order of one to two inches. Consequently, a relatively small amount of power would be absorbed by the web.

One coil redesign and the test results obtained with it are shown in Fig. 6. This coil represents an attempt to achieve maximum coupling between the coil and the core of the billet through the bottom surface and a much smaller coupling between the coil and the upper surface and web of the billet. A marked decrease in thermal gradient was demonstrated, as shown in the figure.

A further significant fact which emerged from this investigation was the feasibility of heating the billet in proximity to the bending blocks, sliding the spar cap a few inches, placing the billet in the bending blocks, and carrying out the bending operation, with heat being generated continuously during the operation. Adjustment of the input heating cycle power would insure exact temperature control during the complete operation.

Save and Win with War Bonds

"AN LST HAD TO BE READY WITHIN 96 HOURS"

PENNSALT CLEANER #23

helped finish the job in 48

Here's the story as our own technician tells it:

PROBLEM: The subject company makes LST (landing ships for tanks). Deck plates are made at a distant plant and, to prevent rusting, are painted with a zinc chromate base in a bakelite or glyceral phthalate vehicle. The shop men had great difficulty in stripping this paint from the plates and the chief chemist called on us because he believed we might have had some experience. It was 11 a.m. Friday when we were called in. *He told us that one of the ships, which still needed deck plates installed, had to be complete for a trial run within 96 hours.*

EQUIPMENT USED: As speed was essential, a special wooden tank was built and lined with sheet metal.

METHOD USED: A solution of Pennsalt Cleaner #23 was made up and heated to 212° F. The deck plates were immersed for 15 minutes, rinsed and dried.

RESULTS: At 11 a.m. Sunday (exactly 48 hours after we were called in) enough plates had been stripped for four LST's and all necessary plates were installed in the ship required for test run.

REMARKS: Customer was greatly pleased. Pennsalt Cleaner #23 was the only satisfactory stripper they had tried. They were pleased too because the job saved 48 hours.

Let our technical staff consult with *you*. Perhaps one of this famous family of Pennsalt Cleaners can help save time, material or labor on your specific metal cleaning problem. Write fully to our Special Chemicals Division, Dept. AA.

PENNSYLVANIA SALT MANUFACTURING COMPANY
Chemicals
1000 WIDENER BUILDING, PHILADELPHIA 7, PA.
New York • Chicago • St. Louis • Pittsburgh • Minneapolis • Wyandotte • Tacoma

SPECIAL CHEMICALS DIVISION PRODUCTS

Acid-Proof Cements • Alkali-Proof Cements • Lead Fluoborate Concentrates • Fluoboric Acid • Acid, Alkali and Solvent-Emulsion Type Cleaners • Paint Strippers.

Thornycroft Truck Has Wheel Hub Drive Gears

Built to comply with requirements of the British War Office, a four-wheel-drive Thornycroft truck, of which some particulars have been published in England, has a reduction ratio of 2.35 to 1 in the helical bevel gearing of the front and rear axles, but a further reduction of 3.16 to 1 is secured by planetary gearing in the wheel hubs. This arrangement, besides reducing the dimensions and weight of the axle gears and giving increased ground clearance below them, relieves the axle driveshafts of considerable torque stresses in the low series of gear ratios.

A distinctive feature of the transmission, which has eight forward speeds, is that movement of the gearshift lever when the change is made from or to the low or the high series of gears also has effect in coupling or disconnecting the drive to the front wheels, for the latter transmit driving torque only when the low series of gears is in use. Thus the driver is not required to decide when or whether it is necessary to use the front wheel drive.

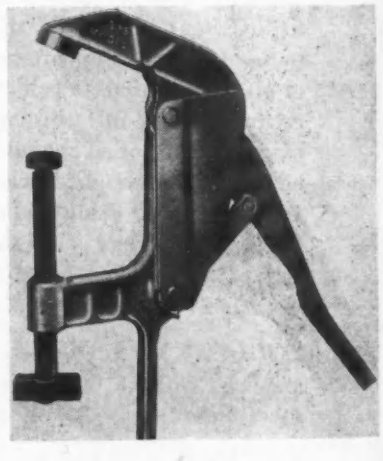
Alternative and strictly interchangeable power units for this chassis are gasoline and Diesel engines, each having four cylinders and each of approximately 312 cu in. piston displacement. The gasoline unit, with a bore and stroke of 4⅜ by 5½ in. develops 85 bhp at the governed speed of 2500 rpm and is equipped with a Zenith ether starting carburetor, which gives quick and certain starting from cold at temperatures down to minus 40 F. The oil engine develops 61 bhp at 1700 rpm, the bore and stroke in this case being 4⅛ by 6 in.

Vickers-Warwick Transport Plane

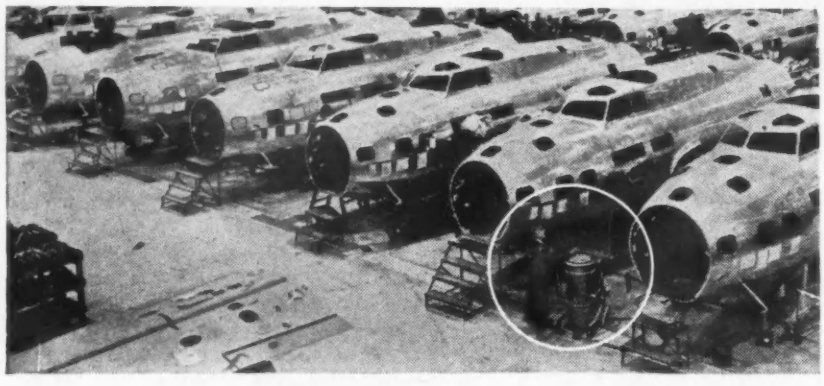
Many exterior features disclosing that the design was based on the Wellington medium (two-engined) bomber are attached to the Vickers-Warwick transport plane, of which the following preliminary particulars have recently been issued by the British Ministry of Aircraft Production: It is in service with the Royal Air Force in many theaters of war, used as a passenger and freight carrier and various other capacities, and is powered by two Pratt and Whitney Double-Wasp engines of either the S. 1A4-G or 2 SB-G type, 1850 hp and 2000 hp, respectively. The fuselage follows Wellington practice in being of geodetic construction.

The wing span is 96 ft 8 in., length overall 70 ft 6 in., wing area (gross) 1006 sq ft and total airworthy weight 45,000 lb. No information has been released regarding its capacity in either passengers or freight.

Knu-Vise Clamp is Redesigned



KNU-VISE, INC., Detroit, Mich., has redesigned the Model 505 "C" clamp. This model has greater strength and throat capacity than the former models. The use of a forging gives the clamp its added strength and permits a reduction in weight. A wing nut replaces the knurled head on the adjusting screw.

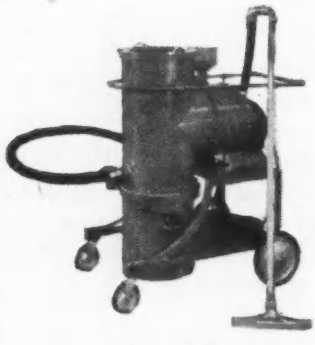


BIG BUSINESS
with a little SPENCER VACUUM

Properly applied, a little vacuum goes a long way, as you can see from the above illustration.

What would it mean to your plant if you could remove all chips, rivets, sawdust or dirt from the job between each operation? Users say that cleaning before painting alone saves the cost of a Spencer Vacuum. In addition the same machine can reclaim materials, improve fire and health hazards, move materials and save time in cleaning machinery, floors, walls and ceilings.

Spencers range in size from the ¾ and 1½ horsepower portable shown to the large stationary systems which can be piped to any part of the plant. Vacuum tools are provided for every kind of service, and for every kind of material from lead to liquids and from lint to the finest powders. Ask for the bulletins.



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WINGS
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SERVICING

SPENCER HARTFORD VACUUM CLEANING
THE SPENCER TURBINE COMPANY, HARTFORD 6, CONN.

AIR POWER THROUGH PISTON RINGS

McQUAY-NORRIS
ALTINIZED
PISTON RINGS

PISTONS...PINS...
HARDENED AND GROUND PARTS

Every McQuay-Norris part in modern airplane motors is backed by 34 years of experience and progress in precision manufacture. Today the world's largest makers of aircraft motors are availing themselves of our broad background of metallurgical development, heat treating, clinical research and engineering design. Your inquiries are invited.

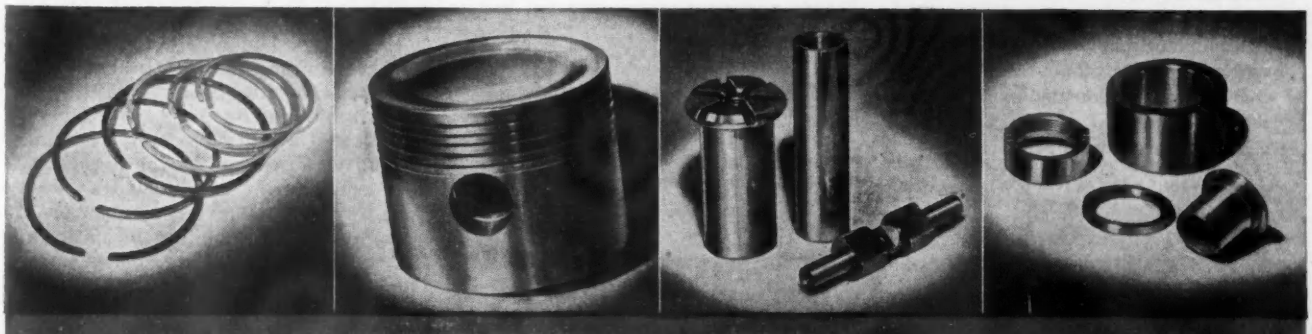
PARTS FOR AIRCRAFT ENGINES
Piston Rings
Oil Sealing Rings
Supercharger Rings
Carburetor Parts
Machined Aluminum Pistons
Piston Pins
Counterweight Cheek Pins
Machined Magnesium Parts
Cylinder Hold Down Nuts
Hardened and Ground Parts

PARTS FOR PROPELLER ASSEMBLY
Machined Magnesium Parts
Piston Rings

EQUIPMENT FOR MAINTENANCE OF AIRCRAFT
Pistons for Oxygen Compressor
Piston Rings for Oxygen Compressor
Pins for Oxygen Compressor
Pistons for Air Compressor
Pins for Air Compressor
Piston Rings for Air Compressor

LANDING GEAR PARTS
Machined Aluminum Pistons
Piston Rings
Hardened and Ground Parts

PRECISION WORKERS IN IRON, STEEL, ALUMINUM, BRONZE, MAGNESIUM



McQUAY-NORRIS MFG. CO. (AIRCRAFT DIVISION), ST. LOUIS, U.S.A.
CANADIAN PLANT, TORONTO, ONTARIO

What Is Full Employment?

(*Continued from page 17*)

No one can arbitrarily say what number of persons should be employed in order that we may enjoy the "more abundant life." Economically there was a time when nearly everyone in the nation had to work. That was in the pioneer days when the frontier of U. S. civilization was constantly expanding westward and there were more potential jobs than persons to fill them. This was followed by a great influx of immigrants from Europe. The ratio of the labor force to the nation's population 10 years of age and older has shown a constant decline over the last 35 years. Whereas 53.3 per cent of the nation's population over 10 was gainfully employed in 1909, this has gradually decreased until only 48.9 per cent was so employed in 1942, according to the National Industrial Conference Board. Labor-saving machinery and technological improvements in industry have been responsible for some of this decrease. Why do we refer to "labor-saving machinery" if our purpose is not to save people from labor?

Moreover, the present emergency is not typical of the normal employment situation and should not be so construed. This only tends to confuse thinking on the subject. There are cases where entire families are now working, including grandmother, father, mother, daughters and minor children. When the grandmother returns to the home after the war, is she to be considered among the "unemployed"? Many older men have come out of retirement to help the war effort and they are carrying on in jobs while their sons and grandsons are in the armed forces. This has reversed the trend in which the retirement age for individuals in the U. S. was being continually lowered. Are these older men to be classed as "unemployed" when they go back into retirement after the war?

Many marginal employes not possessing the mental or physical capacities to fill jobs well have gained employment during the war emergency. There is a temporary character to many of the wartime jobs they are holding. These individuals will try to cling to their emergency jobs after the emergency is ended but the competitive nature of the labor market may make many of them unemployed. They may be so classed from a humanitarian viewpoint but many of them may not be able to hold a job for any considerable length of time due to their deficiencies.

The assumption also has been made that 11 million jobs must be ready for returning servicemen after the war so that every veteran will have a job. This is erroneous because thousands of servicemen will avail themselves of the opportunities offered them to continue or expand their education. Others, unfortunately, will be hospitalized and unable to work, while several million may be retained in the armed forces as a security measure.

In the long run, whose "right to work" should the nation be concerned about? Two persons may be contesting for an open job—one whose living is assured by other circumstances and another who is economically dependent upon that job. Which person deserves the job? Union practice is for the person with seniority to get the job. But is that always the fairest and most equitable way?

It is the nation's habit to think of "full employment" as the highest point of employment ever reached. Carried to its ridiculous extreme, ultimate "full employment" would be the nation's entire population. In the emergency period we have *passed* the normal point of full employment.

In the end, who should work? Should it be all who want and like to work, all who can work or all who must work? What considerations other than economic ones impel a person to seek

OBJECTIVE...get there!

Even before Pearl Harbor Uncle Sam enenlisted VISCO-METER* into various branches of government service. When an assignment is given to any vehicle, land or water, propelled by an internal combustion engine, it is vital to the war effort that the assignment be carried out! Uncompleted missions, because of lubricating oil failures, cannot be tolerated. So it is essential in the conduct of the war that lubricating oil troubles be guarded against before they happen.

That's VISCO-METER'S* job—on land and sea—watchdoggin' on the gasoline and Diesel engines that power many of our fighting vehicles, and it has been doing a swell job—repeatedly assuring completed missions.

There's nothing more convincing than a service record and *now* is the time to talk to a VISCO-METER* engineer who will be glad to tell you of its outstanding performance and decided advantages.

Whether you design, produce or use internal combustion engines, write today.

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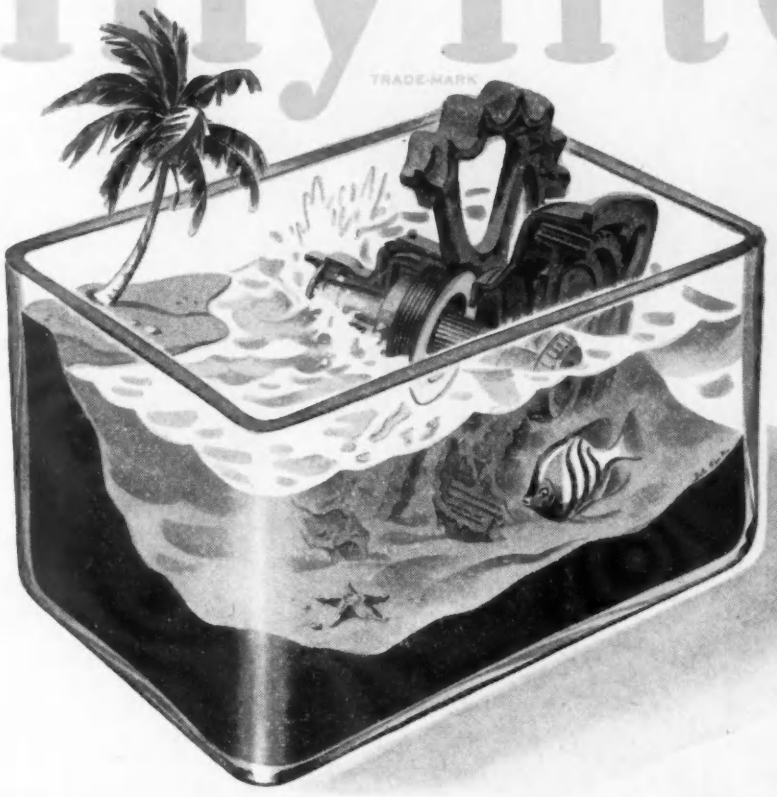
Vinylite

TRADE-MARK



IT'S LITTLE THINGS LIKE GLUE LINES

that help win Campaigns in War and Industry

"On arrival at one of the Solomon Islands, we found an abandoned 'cat.' With jammed transmission, it had been dumped into the ocean 3 weeks earlier, thought impossible to repair . . . The Seabees fished it out . . . repaired transmission . . . in such a hurry they didn't even open the final drive . . . Working it 24 hours a day for 2 weeks, they established a base in enemy territory . . . 8 months later the machine was still in service, working hard." (From report of a Chief Petty Officer of the U. S. Navy).

A thin line of adhesive based on VINYLITE resin contributed in no small way to this remarkable service record. This adhesive is used to seal a cork gasket to the copper bellows of the final-drive sprocket shown in the cutaway view. This seal protects the precision mechanism that drives the endless tracks . . . through mud, muck, and sand. The outstanding tenacity and durability of the VINYLITE resin adhesive have been amply demonstrated on all the world-wide fronts where Caterpillar tractors are making history.

An adhesive that will withstand these severe tests on the war's exacting proving grounds will solve some manufacturers' postwar problems—whether it be a bond for metal, stone, cloth, paper, wood or plastics. Our Development Laboratories will be glad to help you adapt VINYLITE resin adhesive to your specific needs. Write Department 15 for literature.

Plastics Division

CARBIDE AND CARBON CHEMICALS CORPORATION

Unit of Union Carbide and Carbon Corporation

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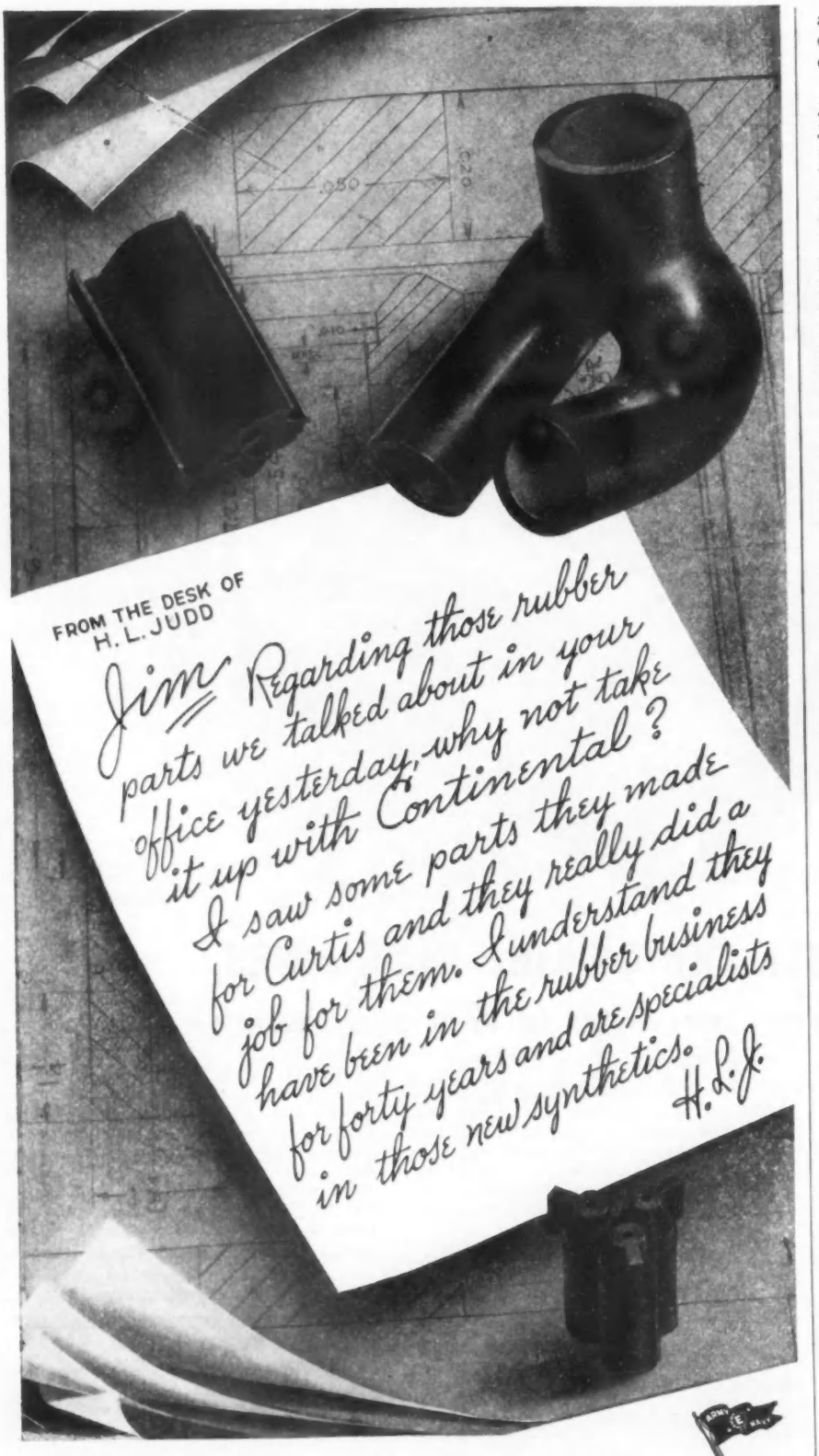
Plastics


FROM THE DESK OF
H. L. JUDD
Jim Regarding those rubber parts we talked about in your office yesterday, why not take it up with Continental? I saw some parts they made for Curtis and they really did a job for them. I understand they have been in the rubber business for forty years and are specialists in those new synthetics.
H. L. J.

BRANCHES

Baltimore, Md.	Cleveland, Ohio	Kansas City, Mo.	Philadelphia, Pa.
Boston, Mass.	Dallas, Texas	Los Angeles, Cal.	Pittsburgh, Pa.
Buffalo, N. Y.	Dayton, Ohio	Memphis, Tenn.	Rochester, N. Y.
Chicago, Ill.	Detroit, Mich.	Milwaukee, Wis.	San Francisco, Cal.
Cincinnati, Ohio	Indianapolis, Ind.	New York, N. Y.	St. Louis, Mo.

CONTINENTAL RUBBER WORKS
ERIE, PENNSYLVANIA, U. S. A.

a job? Some work for excitement, others to escape boredom and still others others to satisfy ambition.

Who has the "right" to a postwar job? Children are barred from many jobs for health reasons but these minors are allowed to work if they obtain work permits, which are granted only after the economic and physical circumstances of the case have been investigated. Extension of this principle might be established in the postwar period, with work certificates for those entitled to job priorities. This would assure the first opportunity at jobs to those economically dependent upon them. A similar problem was encountered in the recent depression years, when some employers released workers who could most afford to do without their jobs. Such practices probably would be followed in any system of postwar job priorities that might be worked out.

This war has taught us the rudiments of manpower management. An effort should be made in the postwar period to match our labor supply with the labor demand, not to try to create enough jobs to the fit the number of potential workers. Sometimes the rights of the individual may be transgressed but this would seem to be the correct course to follow in doing the greatest good for the greatest number.

Airbriefs

(*Continued from page* 33)

changeably in the same ships. The Germans attach their cowlings, etc., to the engines and then the whole works can rock in a rubber motor mount without distorting the cowling.

Supercharging

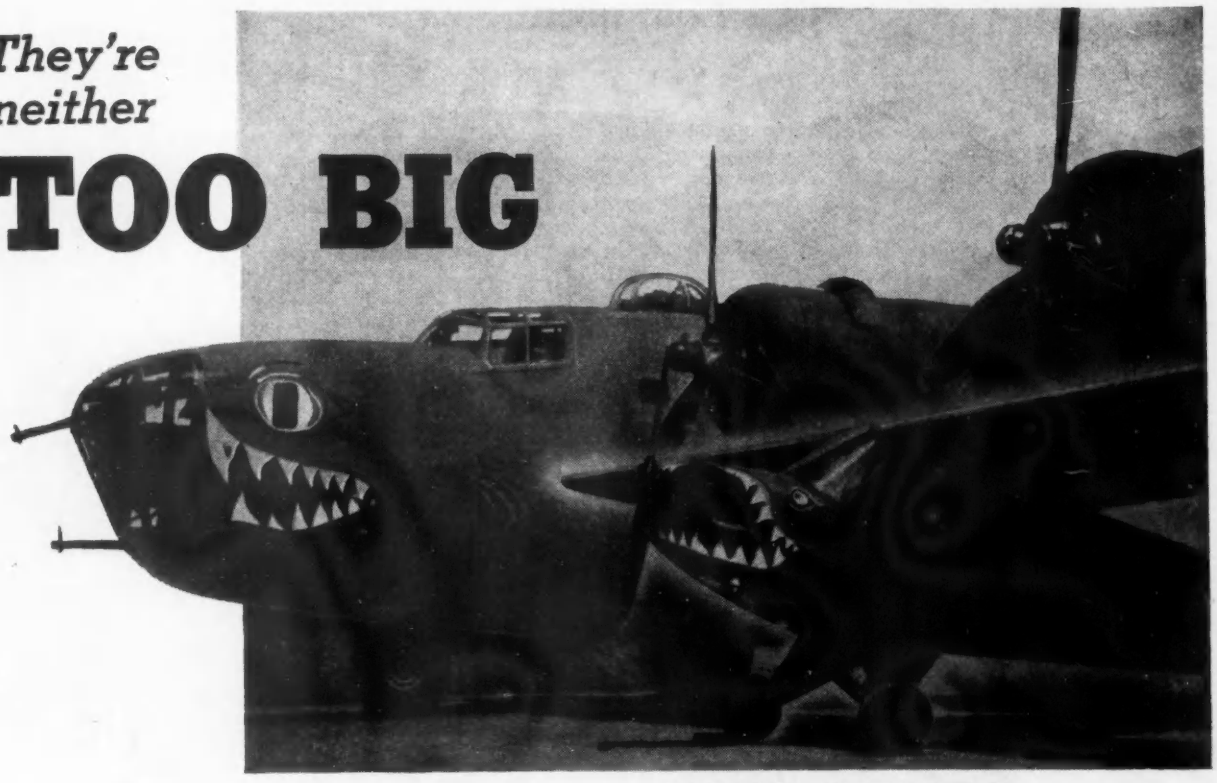
While we don't hear much about the Diesel engine it appears that some enemy observation and medium bombers are being fitted with Junkers Ju86-K engines supercharged to 50,000 feet through a novel combination of superchargers using a mechanical type for low altitudes and then putting in series an exhaust turbine type for high flying.

Laminates

Materials which hold great promise are laminates made of wood veneer alternated with paper or cloth or else combinations of paper and cloth. I wrote an article some weeks ago in "Airbriefs" dealing with small private amphibians and I have since that made some tests on sheets of combined veneer and cloth panels. Such materials hold, I believe, the key to some of the problem involved in such a ship as well as light boat hulls.

They're neither

TOO BIG



nor TOO SMALL . . . .

Side by side at a South Pacific base you see a B-24 Liberator and a Piper Cub — both equipped with *Hayes Wheels and Expander Tube Brakes.*

For planes of all weights and landing speeds—*Hayes'* continuous research, test and design improvement move ahead with the industry.

Big or little — from Fortresses and Liberators (*Hayes Wheels and Expander Tube Brakes* are on every U.S. 4-engine bomber)— through land and carrier based lists: medium, torpedo and dive bombers, fighters, transports, trainers, Cubs and Grasshoppers — *Hayes Wheels and Brakes* are in action around the world.

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WHEELS AND BRAKES

Western Representative:
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HAYES INDUSTRIES, INC. Home Office: JACKSON, MICHIGAN, U. S. A.

New Production Equipment

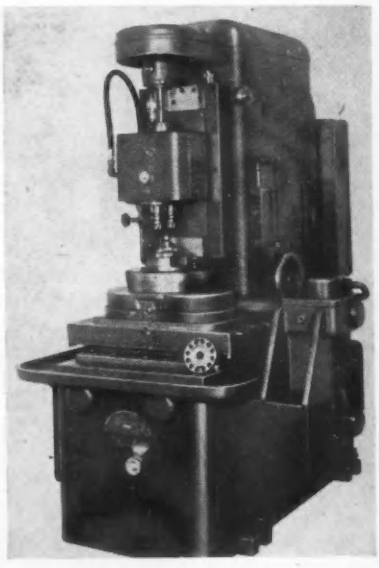
(*Continued from page* 44)

typical of gage blocks. Sizes start at four inches (upright measurement from base surface) and can be obtained in larger dimensions as desired.

A SPECIAL machine has been designed and built by Snyder Tool & Engineering Company, Detroit, Mich., for milling radius-shaped slots connecting two holes, as shown in the work part near the fixture slide. Six slots, each connecting two holes, are cut in each flange.

In this operation, the two-spindle head advances rapidly toward the work which is slowly reciprocating through an arc the length of the slot.

Hydraulic fluid motor feed mechanism within the column allows head and tools to move into the work in small steps of .010 in. to .060 in., per reciprocation of the part. As each pair of slots is finish cut, the tools retract rapidly, the hydraulic feed automatically resets itself and the fixture is indexed 60 deg, bringing the flange into position for the next cycle.



Special Snyder machine

The round table contains the index and table positioning mechanism. Index drive is through a splined shaft from the right hand side of the machine where the index drive motor, worm wheel and control mechanism are mounted. Reciprocation of the main table is through rack and pinion by means of hydraulic cylinder plungers, and is continuous throughout the entire machining cycle. Base and column contain all hydraulic mechanism and piping. Coolant and hydraulic tanks are mounted on the side.

THE Lincoln Engineering Company, St. Louis, Mo., has just announced that their Centro-Matic lubricating systems are now available in complete kits, ready for installation on all types of standard punch presses.

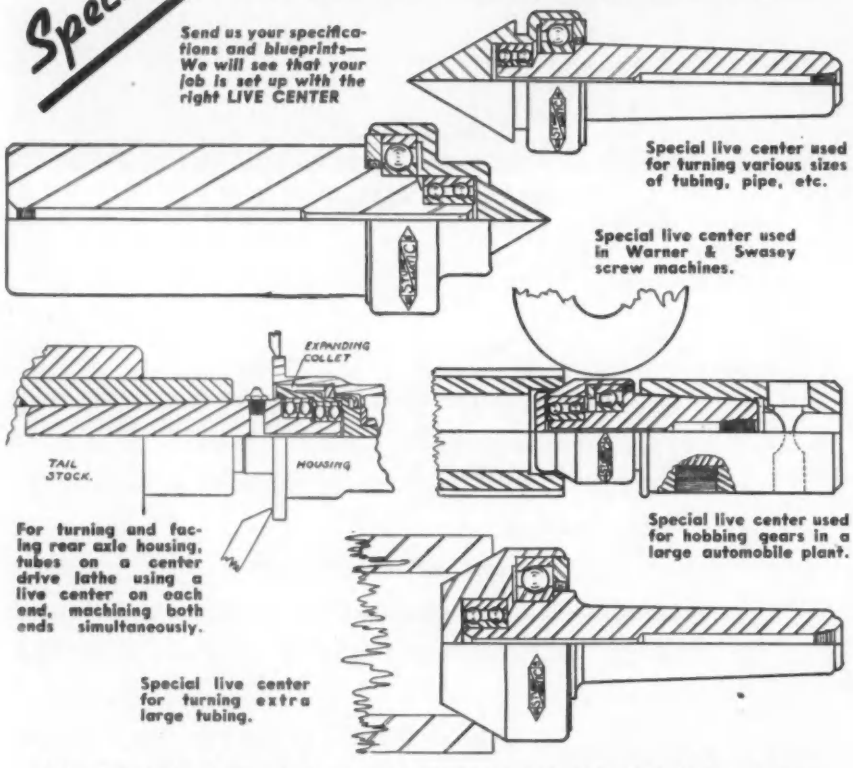
These kits contain injectors, pump, and necessary tubing brackets, bolts and fittings—everything needed for the proper lubrication of all heavy-duty bearings of punch presses.

Lincoln Centro-Matic lubricating systems feature a single lubricant supply

Centro-Matic lubricating system kit

Special Live Centers

Send us your specifications and blueprints—We will see that your job is set up with the right LIVE CENTER



Special live center used for turning various sizes of tubing, pipe, etc.

Special live center used in Warner & Swasey screw machines.

For turning and facing rear axle housing, tubes on a center drive lathe using a live center on each end, machining both ends simultaneously.

Special live center used for hobbing gears in a large automobile plant.

Special live center for turning extra large tubing.

Characteristic of the design of all STURDIMATIC LIVE CENTERS is a low overhang and a slight cushioning action . . . that compensates for expansion due to heat, shock and excessive thrust loads—reducing wear to a minimum. A properly engineered live center is one of the fundamentals of setting up a job and requires a specialist's experience . . . standard shanks with Morse taper carried in stock. Prompt deliveries on high priorities.

STURDIMATIC TOOL COMPANY
5226 THIRD AVE. DETROIT, MICH.

SAVES AIR TIME MONEY

HANSEN AIRLINE EQUIPMENT

Hansen PUSH-TITE air hose sockets, hose clamps and hose clamp sockets are widely used in aviation plants, shipyards, large and small industrial factories in all parts of the world. They save air, time and money but that is only part of their job—they also increase production far beyond your present peak. ◆ No fussing, twisting or turning with a Hansen PUSH-TITE socket you merely push plug into socket, it is locked tight, air is automatically turned on . . . instantaneous action. To disconnect, merely slide sleeve back, plug is ejected, air automatically turned off. No wastage of air, time or effort. ◆ The above illustration shows Hansen PUSH-TITE air hose socket, hose clamp and hose clamp socket the latter a combination of the other two. Hose clamp and socket can be used together or separately as shown. Hose clamp has two grips instead of customary one, two to one advantages and will handle a safe working pressure of 500 pounds. Require no special tools to install and can be used many times over.

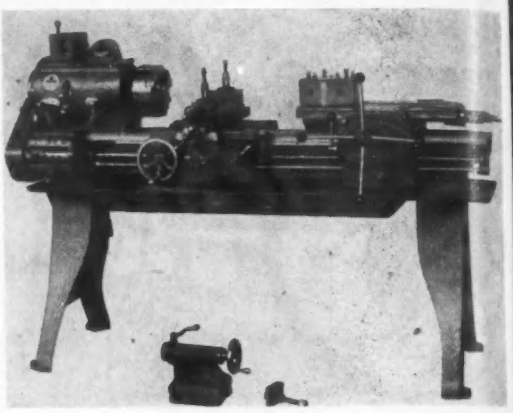
Send for free Industrial Catalog today!

THE HANSEN MFG. CO.

1786 EAST 27th STREET . . CLEVELAND, OHIO

line, injectors that can be adjusted so they will deliver a measured amount of lubricant to each bearing, and a hand-operated pump that can be attached to the machine in an out-of-the-way position.

A HEXAGON bed turret is now supplied on the 13-in. and 15-in. Regal lathes made by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. It is available with power feed or hand feed only. It is a six-station head, 9 in. across faces, supported on double preloaded adjustable precision roller bearings. The turret block is automatically indexed to the next station when the ram is returned against the indexing trip by the pilot wheel, or it can be spun by hand to any face of the turret in either direction. The forward feeding motion of the ram is automatically disengaged when the stop screws move against the trip. The total length of travel of the ram with either hand, or power feed, is 6¼ in. The face dimensions of the turret are 3¼ in. by 4½ in. The bored hole in the face is 1 in. Drive for the turret apron is taken from the feed rod, thus the full range of feeds (.0025 in. to .144 in.) is available and selected by the quick change feed box.



Regal lathe with hexagon bed turret

The apron is similar in design and has all the advantages of the regular carriage apron, including positive feed, automatic forced lubrication and a safety device on the feed rod that releases the feed when undue pressure is put on the tool or some obstruction gets in the way of the forward movement of the ram.

The saddle casting takes the same bearing on the ways as the tailstock. When the turret is put on the lathe at the factory, the holes in the turret can be bored to customer's specifications up to 1 in. The turret will take #2 tools projecting 9½ in.

THE Wilson Welder and Metals Co., New York, N. Y., is producing a new coated aluminum-bronze electrode—Wilson No. 200. This coated high tensile bronze electrode is a shielded arc electrode, and can also be used as a filler rod in carbon arc welding. It is said to produce welding deposits of great strength and hot ductility, combined with desirable resistance to corrosion. Deposits made with the Wilson No. 200 electrode are superior to standard manganese bronze with respect to corrosion resistance, and are equal to it in strength, hardness and ductility.

The Wilson No. 200 has a most universal application in the welding of most bronzes, malleable and cast iron, or steel. In addition, it has other specific applications for which it is especially suited, such as welding manganese bronze conforming to Federal specifications QQ-B-726b, or Navy specifications 49-B-3e for marine propellers and other parts where great

Paasche
AIRPAINTING EQUIPMENT
Airpainting parts for the famous Curtiss Caravan in a plant somewhere in Kentucky. Paasche Equipment speeds the job!
WINGS for FINISHING
When Paasche Airpainting Equipment works for you, Finishing flows along at top speed. Paasche High Production Airbrushes provide fastest application of painting and finishing materials. Exclusive design of Paasche Material Tanks saves time in paint handling.
But time-saving is only one of the many advantages gained. The Paasche Water Wash Booths (interior shown above) reduce fire hazards, provide healthier, cleaner surroundings for workers, conserve paint and save cleaning time and cost.
Send for your copy of the new Paasche catalog and at the same time get the assistance of our experienced engineering staff. We will be glad to assist you on your difficult or unusual Finishing problems and help you attain maximum production. Write
PAASCHE AIRBRUSH COMPANY
1956 Diversey P'kw'y, Chicago 14, Ill.
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110 Elm Street, Toronto
PUT THIS GUN IN THE HANDS OF YOUR FINISHING MEN
The Paasche CUB High-Production Airbrush provides extra rapid application of all painting and finishing materials; perfect atomization and spray pattern; it's easier to handle too, weighs only 22 ounces.
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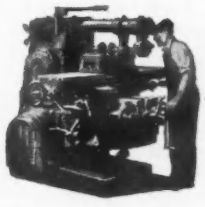
AIRPAINTING EQUIPMENT
Manual, automatic and special airpainting equipment, airfinishing booths, pressure regulators, airconditioners for compressed air lines, air dusters and stripers.

Will your products be on the Salesfloors of the better Dealers tomorrow?

What will your †† future **I.P.** *be?*

This is the Fifth of a series of advertisements presenting "Industrial Par" and its importance to your company in all future planning. Save this and succeeding I.P. advertisements as the basis for discussion and as a guide to your planning program.

. . Your Company's I.P. May Be The Deciding Factor



THE return to peacetime production won't be accomplished without industrial "casualties"—every realistic business thinker knows that some mortality is inevitable in such adjustment.

Farsighted planning now will enable many companies to carry on and through — they will re-establish and hold places for their products on sales floors of the better dealers tomorrow.

Such planning recognizes that there will be many problems beyond the control of management — to be met as they arise with immediate resourcefulness. Well-conceived, thorough postwar plans of action concern themselves properly with the known factors—the anticipated trends of the peacetime future.

It is a certainty that even well-known, long established industrial firms will encounter new competition — new, aggressive organizations, unfettered by any traditional methods of manufacturing and marketing, who are determined to challenge the places which older, prewar companies believe they hold in the industrial world.

And it is another certainty that buyers in the postwar world won't differ materially in their usual habits — they will want values for their dollars, not mediocre products at de luxe prices. Those manufacturers, whether entrenched or newcomers in a given market, who are best equipped to provide better products at attractive prices can expect to fare best in the coming battle of competitive production. To make better products—at lower cost—will demand production-engineering skill implemented with the best modern machine tools.

Such production has its roots in man-hour output. Only by maintaining or excelling our expected national *industrial par* can we attain security of jobs and wages for the greatest number of workers. The vital significance of *industrial par* to industry is summarized in the panel headed "Spotlight Facts for Your Future I.P. Planning."

In the new competition — postwar — the farsighted manufacturer will look to the most modern and advanced machine tools as the most effective means of maintaining *industrial par* and its benefits in terms of employment — better production at lower cost.

Let's all Back the Attack! **BUY MORE BONDS**

Spotlight facts for your future I.P. *planning*

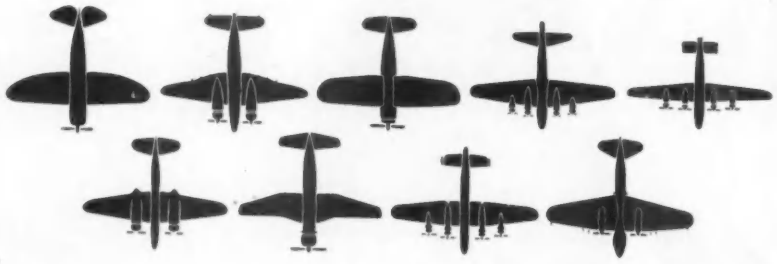
* Production methods — developed in wartime —increase man-hour output; pent-up buying power — released in peacetime — demands increased production.
* The rate of 2½% increase per year output per man-hour, established by a 12 year record of industrial production, can be expected to reach at least 4% per year — compounded.
* Manufacturers must set a goal of 50% increased output per man-hour every 10 years — to maintain a high level of national prosperity and achieve its benefits in terms of security of jobs and wages for the greatest number of workers and the volume production of more goods for more people at lowest cost.
* Machine tools — the most modern, most efficient — are recognized as the most effective implements of mass production and increased output at lowest cost — but only continual replacements with the newest and finest machine tools assures full productive capacity. *Such replacements yearly should be equal to 10% of the total machine tool investment — in keeping with increased output.*
* The cost of machine tools is insignificant in terms of their productive power . . . from 1927 to 1937, according to census reports, American manufacturers had only a total of about 2% invested yearly in machine tools in ratio to a total volume of 9 billion dollars' worth of production annually.

†† **Industrial Par** — *the constantly increasing output per man-hour equal to approximately 50% every 10 years.*

KEARNEY & TRECKER
CORPORATION
MILWAUKEE 14 WISCONSIN

Milwaukee Machine Tools

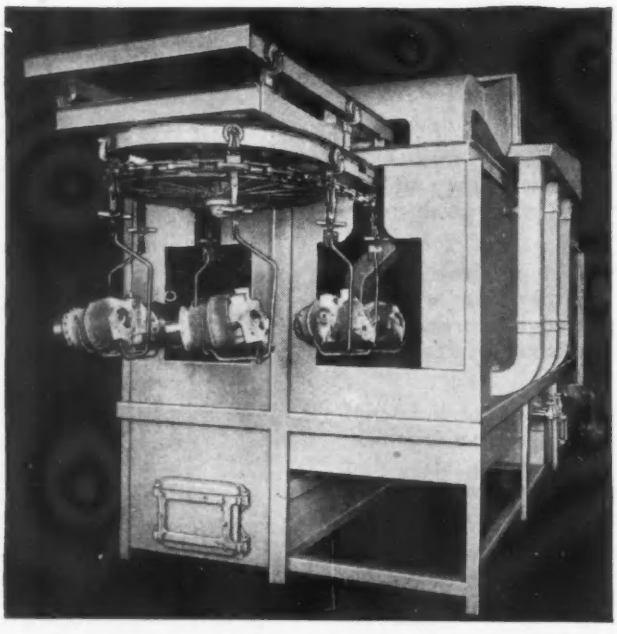
Can YOU Identify These Planes?



NO LONGER regarded as a necessary nuisance, the cleaning and finishing of metal parts and products has become an integral part of the production routine of practically every airplane engine manufacturer.

Many have come to Alvey-Ferguson for custom-built A-F Cleaning and Finishing Equipment to perform specialized cleaning and finishing functions for quality control which could not be performed by regular standard equipment.

Whatever you manufacture, you can probably clean it better, more *efficiently* and at lower cost over a period of time with A-F Equipment. Write us about it—today.



FIRST in the field of package handling since 1901, and specialists in the application of materials and products handling as well as metal products cleaning and finishing, A-F Engineers have now timed the cleaning of airplane engine parts with the precision machining operation.

ARMY E NAVY

Incidentally, the above planes are: Republic P-47 Thunderbolt . . . Vega B-34 Ventura . . . Voight F-40 Corsair . . . Boeing B-17 Flying Fortress . . . Consolidated B-24 Liberator . . . Martin A-30 Baltimore . . . Vultee A-31 Vengeance . . . Avro Lancaster 1 (Br.) . . . Ilyuchin 2 Stormovik (Russian). Courtesy Aviation.

THE ALVEY-FERGUSON COMPANY

23 DISNEY STREET — Offices in Principal Cities — CINCINNATI 9, OHIO

Affiliated Corporation:

The Alvey-Ferguson Co. of California, P. O. Box 396, Vernon Branch, Los Angeles 11, California

CONVEYING EQUIPMENT

A-F CONVEYING MACHINERY

Alvey-Ferguson

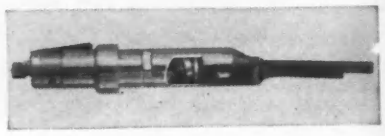
METAL PRODUCTS CLEANING & FINISHING EQUIPMENT

strength, ductility and corrosion resistance are strict requirements.

The Wilson No. 200 can also be used for welding dissimilar metals, such as cast iron to brass, steel to malleable iron, or the joining of any two metals which are weldable with aluminum-bronze.

KELLER TOOL COMPANY, Grand Haven, Mich., offers a pneumatic hand tool for finish filing. This new tool, Number 000-F Model 1416, is made in one size with a free speed rating of 1500 strokes per minute and with a fixed strength of file stroke of 7/16 in. It can also be used as a portable power saw for making irregular saw cuts by substituting a hack saw blade for the usual file.

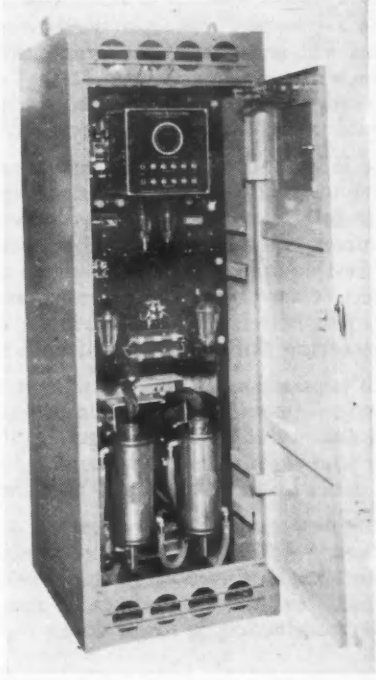
The design of the filing tool includes



Keller pneumatic hand tool

the 000 Keller rotary air motor together with a new cam and piston utilizing a ball bearing assembly to transfer the rotary motion of the motor to the reciprocating motion of the file. The use of a standard ball bearing set at an angle of 27 deg with a cam angle of 25 deg assures contact between the cam and the outer ball race, while the inner race is fixed to the piston and does not contact the cam surface.

A CONTROL designed exclusively for seam welding, and incorporating a completely electronic timing circuit, has



GE resistance welding control

★ PROVING GROUNDS

In the mighty engines that drive DE boats . . . in the high-precision motors of Allied war planes (80 *types*) . . . in tanks, trucks, jeeps and other ground-borne motorized units—American Hammered Piston Rings are rendering distinguished service. On the home-front, too, American Hammered is supplying the *correct* piston rings —in every size—of every type—for every purpose. Koppers Company, American Hammered Piston Ring Division, Baltimore, Md.

WAR PLANES USING AMERICAN HAMMERED PISTON RINGS

A-20 Havoc
A-22 Maryland
A-24 Dauntless
A-25 Shrike
A-29 Hudson
A-30 Baltimore
A-31 Vengeance
A-34 Buccaneer
A-36 Invader
B-17 Flying Fortress
B-18 Bolo
B-23 Dragon
B-24 Liberator
B-25 Mitchell
B-26 Marauder
B-29 Superfortress
B-34 Ventura
C-43 Traveler
C-45A Voyager
C-46 Commando
C-47 Skytrain
C-53 Skytrooper
C-54 Skymaster
C-56 Lodestar
C-61 Forwarder
C-69 Constellation
C-76 Caravan
C-87 Liberator Express
J-4-F Widgeon
L-1 Vigilant
L-2 Hedgehopper
L-3 Grasshopper
L-4 Grasshopper
L-5 Sentinel
O-52 Owl
P-40F War Hawk
P-43 Lancer
P-47 Thunderbolt
P-51B Mustang
P-61 Black Widow
P-66 Vanguard
AT-6 Texan
AT-7 Navigator
AT-8 Bobcat
AT-9 Jeep
AT-10 Wichita
AT-11 Kansas
AT-13 Yankee Doodle
AT-14 Yankee Doodle
AT-15 Crewmaker
AT-17 Bobcat
AT-19 Reliant
BT-13 Valiant
BT-15 Valiant
PT-13 Caydet
PT-17 Caydet
PT-19 Cornell
PT-22 Recruit
PT-26 Cornell
F2A Buffalo
F4F Wildcat
F4U Corsair
F6F Hellcat
N2T Tutor
OS2U Kingfisher
PBM Mariner
PBY Catalina
PB2Y Coronado
SB2A Bermuda
SB2C Helldiver
SB2U Vindicator
SBD-3 Dauntless
SO3C Seagull
SNC Falcon
SNJ Texan
TBD Devastator
TBF Avenger
JRM-1 Mars
YO-51 Dragonfly
Sikorsky Helicopter

DESTROYER ESCORT (DE) BOAT

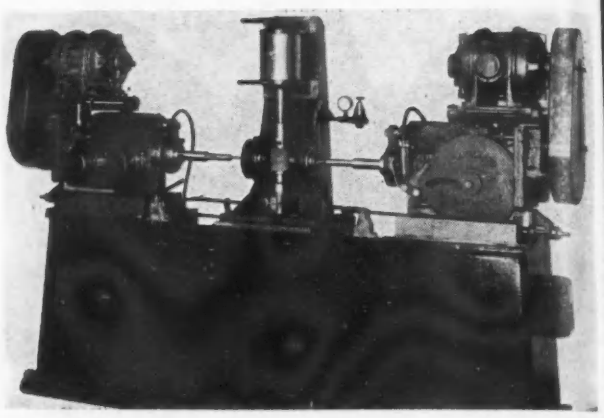
American Hammered Piston Rings

A KOPPERS PRODUCT

been brought out by the General Electric Company, Schenectady, N. Y. Designated as Type CR7503-B110, the new resistance welding control is said to be especially suitable for operations where frequent changes of the timing pattern are required, such as when welding a variety of materials of various shapes and thicknesses.

Operating on a 230/460/575-volt, single-phase, 60-cycle power supply, the control consists of a timing panel, a firing and a heat control panel, and a power panel, any one of which can be separately disconnected and removed to facilitate inspection or servicing. An electronic circuit, incorporated in the control, provides accuracy of the timing pattern of the weld, without utilizing moving parts and regardless of normal, instantaneous, or gradual line-voltage variation. Smooth heat control is provided by the phase-shift method.

The complete control is mounted in a floor-type enclosure, the full-length front and rear doors of which can be locked. A calibrated heat-control dial is located on a panel accessible through a flap opening in the front door of the enclosure. Snap switches for providing instantaneous and independent adjustment of the "heat" and "cool" time in one-cycle steps from one to 30 cycles are also located on this panel.



Millholland piston drilling machine

THE W. K. Millholland Machinery Co., Indianapolis, Ind., has designed a piston drilling machine primarily for drilling piston pin holes in job lots of pistons for replacement manufacturing where various sizes of pistons are put through in relatively small lots.

The machine will take pistons from 2¾ in. diameter to 6 in. diameter. It is a double end machine having two No. 4 Millholland automatic cam operated drilling units mounted opposed on a welded steel bed. The two Millholland automatic units have motors mounted on top with multiple V-belt drive to the spindle. Speed changes are made by changing the sheave pulleys. The automatic drill units are mounted in bases and are adjustable for different diameters of pistons. Feed changes are provided by splined pick off gears. Plate cams are provided for various increments of travel for different lengths of piston pin bosses.

A fixture on the machine locates the pistons in the usual manner from the open end and with V-blocks for squaring up by the piston pin bosses.

THE Mallory portable d-c power supply, manufactured by P. R. Mallory & Co., Inc., Indianapolis, Ind., is designed for use on assembly lines, in laboratories and maintenance departments.

It provides a source of portable d-c power for manufacturing, testing and operating all electrical and electronic equipment in aircraft and other units

When you purchase
BEARING
BRONZE

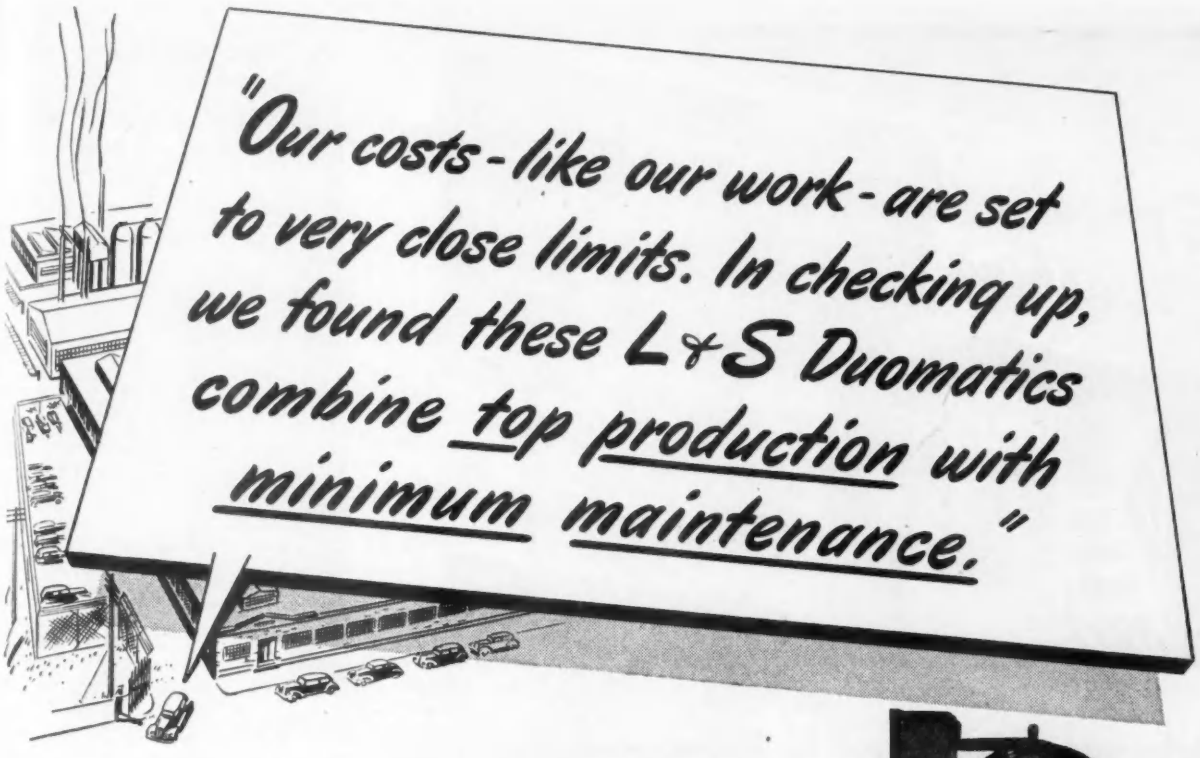
Look for this LABEL

The fundamental reason for applying a trade name to any product is to create "brand preference" with the purchaser. This preference cannot be sustained however, unless the product possesses real merit . . . qualities not obtainable in competitive lines.

This is true of bearing bronze. When you specify Johnson UNIVERSAL you get the highest quality bearing bronze on the market. This quality is apparent when you purchase the bar and definitely proved when you put it to work. The long hours of satisfactory performance . . . the smooth, quiet operation will convince you that you cannot buy a better bearing bronze.

There is only one way to prove this. Try a bar on your next job. Compare it with any bronze you have ever used. Then you . . . like thousands of other manufacturers . . . will consistently specify Johnson UNIVERSAL Bronze. Write for list of stock sizes.

JOHNSON BRONZE
SLEEVE BEARING HEADQUARTERS
625 S. MILL STREET NEW CASTLE, PA.


"Our costs - like our work - are set to very close limits. In checking up, we found these L & S Duomatics combine top production with minimum maintenance."

In thousands of war plants today, large numbers of unskilled and semi-skilled workers operate L & S Duomatic Lathes with amazing efficiency. Automatic controls, shifting responsibility from worker to machine, permit production in greater volume—with improved quality—at lower cost. Such performance a few years back could have been accomplished only by operators of the highest skill.

If your shop is equipped with old or worn lathes, and particularly if the manpower shortage requires hiring of unskilled personnel, learn how L&S Duomatics can help you maintain full production schedules. As the name implies, the 3-A Duomatic has dual carriages and cross-slides, front and rear, operating singly or together on the same or on different cycles. Automatic controls permit exact duplication of sizes and accurate handling of large or small quantities of work. For complete information, write for literature or call on Lodge and Shipley Engineers.

PREPARE FOR THE COMING BATTLE OF MARKETS!

● *Make your plans now for "the way back" to peacetime production. Aim to hit full stride with least delay. Thus, when purchasing a new lathe needed for wartime output, consider also how well adapted it is for future use. Here L & S "engineering foresight" can be of practical help by its proved capacity to build lathes adaptable for varied service through the years. This engineering foresight—result of 52 years specialized lathe experience—makes your wartime Duomatic equally efficient for peacetime use.*

ENGINE
AUTOMATIC
TOOL ROOM
OIL COUNTRY
LATHES

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI 25, OHIO, U. S. A.

L & S LATHES

Detrex is *Unbiased* In Recommending Equipment Best Suited For *Your* Needs

Detrex products meet every modern requirement for Solvent Degreasing . . . Alkali, Spirits and Emulsion Cleaning.

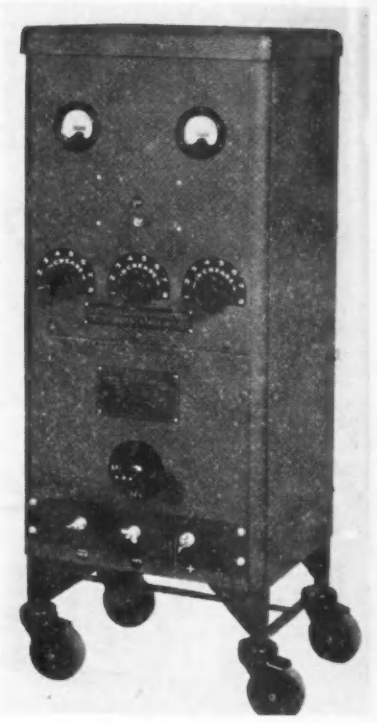
When a Detrex engineer visits your plant to offer recommendations for your metal cleaning operations, his interest is to supply the equipment and chemicals which will do your job most efficiently and economically.

Detrex representatives are in the unique position of having no "axe to grind," and are thoroughly familiar with the machines, solvents and cleaning compounds which can meet your needs *exactly*.

DETREX CORPORATION

13001 HILLVIEW AVENUE • DETROIT 27, MICHIGAN

INVEST IN OUR
COUNTRY'S FUTURE—BUY WAR BONDS

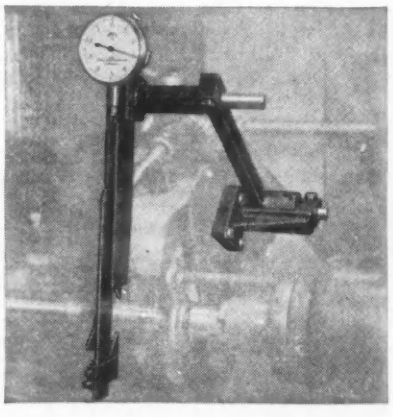


Mallory portable direct-current power supply

employing 12 or 24 volt systems. The power supply can also be used to taper charge batteries or battery parts of similar voltages.

The unit is designed to operate from 3 phase a-c lines of 208 and 230 volts. Three models are offered: No. VAI500, with d-c output of 10 to 16 volts at 100 amp, or 20 to 32 volts at 50 amp; No. VA3000, with d-c output of 10 to 16 volts at 200 amp, or 20 to 32 volts at 100 amp; No. VA4500, with d-c output of 10 to 16 volts at 300 amp, or 20 to 32 volts at 150 amp. Models with similar d-c output but for operation on 460 volts a-c are also available. Rectification is provided by Mallory magnesium-copper sulphide dry disc rectifiers.

THE Stuart Micromatic grinding gage, distributed by Clawson & Bals, Inc., Chicago, Ill., has no gears, levers or angles. The dial is actuated by direct parallel thrust. Contact points of the



Stuart Micromatic grinding gage

ENDURANCE...

In war—victory ultimately depends upon endurance. That is why Long radiators are seeing action in tanks, trucks, and military equipment on all war fronts. Built to defeat the heat of battle—Long radiators will be ready to bring the same trouble-free endurance to post-war vehicles.

LONG

CLUTCHES • RADIATORS • OIL COOLERS

LONG MANUFACTURING DIVISION BORG-WARNER CORPORATION

DETROIT 12, MICHIGAN AND WINDSOR, CANADA

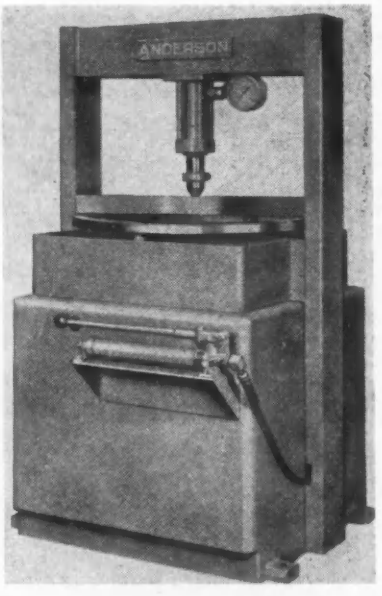
caliper measuring bar are of tungsten carbide. Made in two models, the gage has ranges of ⅛ in. to 1¼ in. and ⅝ in. to 2½ in., respectively. Additional calipers for the larger model provide ranges of 2 in. to 5 in. and 5 in. to 8 in., respectively.

The gage is applied to and taken off the work while the machine is in operation. Hand "miking" is eliminated. The dial indicator guides the operator as the work is ground to size. The gage is said to indicate the correct size even though the sizing controls of the machine may be worn.

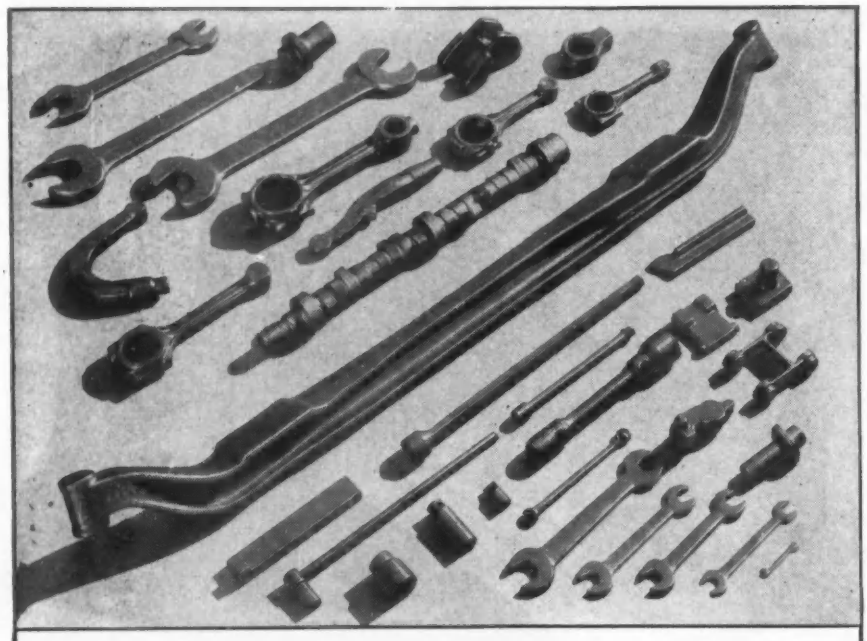
A NEW Doall butt welder has been developed by Continental Machines, Inc., Minneapolis, Minn., which extends the application of the band saw butt welder to that of making extensions to small tools, salvaging broken tools, and for small miscellaneous welding operations. With this new butt welder, steel rods, steel tape, wire and wire forms up to ⅝ in. in diameter are quickly welded. Extensions to drills, screw drivers, small grinding wheels, tape, reamers, and cutting tools can be made quickly. Besides welding these small tools, the butt welder joins all types of band saws in widths up to 1¼ in. One recent application is that of welding the tubular rip cord rings used on parachutes.

Doall butt welder

AN HYDRAULIC press, with a 30-in. square table, for straightening large gear blanks and metal rings is being introduced by Anderson Bros. Mfg. Co., Rockford, Ill. The table is accurately machined and can be used as a checking plate. The press has a capacity of 40,000 lb, and is operated by a hand hydraulic pump. A hydraulic gauge calibrated in pounds indicates the actual pressure on the ram. The stroke of the ram is 5 in. and the maximum vertical opening is 8 in. The floor space is 40 in. x 40 in. and the net weight is 1500 lb.



Anderson hydraulic press



Herbrand
PRECISION FORGINGS

are treated in automatic electric controlled furnaces where exact regulation assures positive results

You men who are designing and building products for war needs or planning post-war developments will find Herbrand exceptionally well qualified to supply precision forgings of any size or shape up to 200 lbs. Our specialized experience dates back to 1881, the year this organization was founded.

Herbrand forgings possess an enduring, inbuilt stamina because they are scientifically heat treated by definite processes in the latest automatic electrically controlled furnaces where constant temperatures and exact regulation give positive results. You are assured forgings free from defects . . . Your inquiries are solicited.

THE HERBRAND CORPORATION
FREMONT, OHIO

For *small* "see-through" parts, too–

PLEXIGLAS

Gunners on American bombers scan the skies through PLEXIGLAS, as nearly everyone familiar with flying knows.

Not so well known is the fact that this acrylic plastic, product of Rohm & Haas research, has many other applications on airplanes.

The crystal clarity of PLEXIGLAS, for example, is a boon to pilots who must fly with eyes ever on the fuel gauge...its great strength shields cameras from wind and weather in reconnaissance...its light weight, applied to a score of parts, saves precious pounds.

Some of these parts are formed and fabricated from PLEXIGLAS sheet; others are molded from PLEXIGLAS powder in fast production—like many of the crystal-clear parts on your prewar and postwar automobile.

TECHNICAL ASSISTANCE

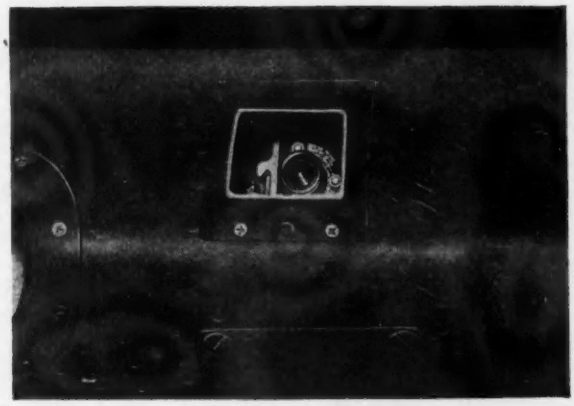
The Rohm & Haas technical service staff is ready to assist you in adapting the inherent advantages of PLEXIGLAS to your own war production or postwar designs.

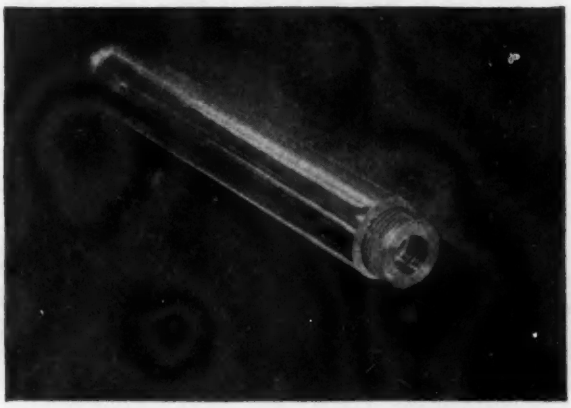
Rohm & Haas physicists will aid in determining best optical contours. Engineers will discuss mechanical details. Production facilities are available for fabrication of experimental sections.

Detroit Office

619 Fisher Building—Madison 6100

***Only Rohm & Haas makes* PLEXIGLAS**





ILLUSTRATIONS: (*Top to bottom*) Bombardier's panel for the Martin B-26, molded by Plastics Manufacturers, Inc.; Motion picture camera window for Republic P-47; Fuel gauges molded by Detroit Macoid. These parts are typical of many airplane applications utilizing the transparency, strength, and weather resistance of PLEXIGLAS.

PLEXIGLAS is the trade-mark Reg. U.S. Pat. Off., for the acrylic resin thermoplastic sheets, rods, and molding powders manufactured by Rohm & Haas Company.

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA, PA.

Manufacturers of Chemicals including Plastics . . . Synthetic Insecticides . . . Fungicides . . . Enzymes . . . Chemicals for the Leather, Textile and other Industries

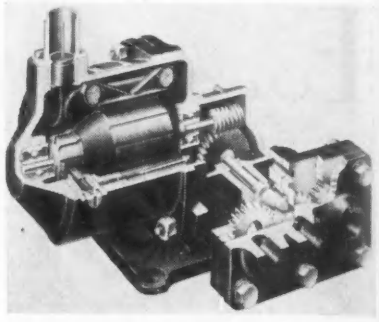
New Products for Aircraft

(*Continued from page 50*)

vide 2.0 to 9.0 gph per outlet, while Type 744 will deliver .5 to 3.0 gph per outlet. Control of motor rpm to vary flow is obtained by either a variable control, or by a fixed or adjustable resistance.

Pumping head parts, lapped to close tolerances, assure dry prime regardless of pump location, and provide intermittent pressures of 350 psi or more to overcome temporary restrictions. Vapor formation and cavitation at altitude are minimized by the positive displacement, low speed, motor-driven, gear type pump designed with integral worm and wheel reduction. Stainless steel alloys used exclusively in the pump head eliminates the possibility of corrosion.

Explosion-proof electric motors incorporate sealed, prelubricated ball bearings and are designed with a large torque reserve to permit starting and continued pump operation under extreme cold.

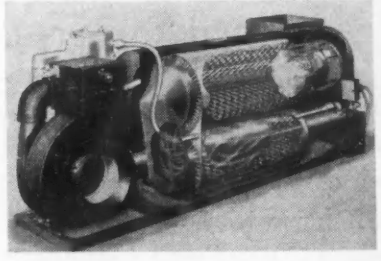


Eclipse Type 744-4 fluid metering pump

The fluid filter prevents foreign matter entering the system from the reservoir, eliminating restrictions from that source, and the fluid pressure and check valve maintain correct pressure in aircraft unit heater systems, returning excess fluid to the reservoir. All fluid metering pump system components are designed to accommodate ⅛-in. NPT forged dural fittings.

Combustion Type Aircraft Heater

An aircraft heater of the combustion type, burning gasoline from the plane's tanks, is being introduced by Anchor Post Fence Co., Baltimore, Md. Now in use on Navy patrol bombers, as well as the giant Mars, it combines the multiple functions of cabin heating in flight and not in flight, with the



Cutaway view of aircraft heater made by Anchor Post Fence Co.

transfer from one phase to the other automatically controlled. Also, it defrosts the pilot's windshield and bombardier's window, in addition to preheating the engines for quicker take offs in arctic temperatures. In tests it is claimed to have functioned properly at temperatures as low as 72 deg below zero and at altitudes up to 40,000 ft. In flight the heater has an hourly output of 90,000 Btu.

New Explosive Rivet

An improved explosive rivet that fits itself to the hole is a recent development of E. I. duPont de Nemours & Company, Inc., Wilmington, Del.

The rivet is expanded from within along substantially its entire shank by

Aviation, Automotive, Bus, Truck, Electrical, Marine, Industrial.

The finest controls that experience, craftsmanship and materials can combine, are yours when you specify Arens.

Arens Remote Controls are recognized for their dependability and unfailing performance regardless of temperature changes, icing, or vibration.

Each Arens Remote Control is built to outlast the equipment on which it is installed and will give years of lowest cost operation with a minimum of maintenance.

We invite you to discuss your present remote control problems with an Arens engineering specialist.

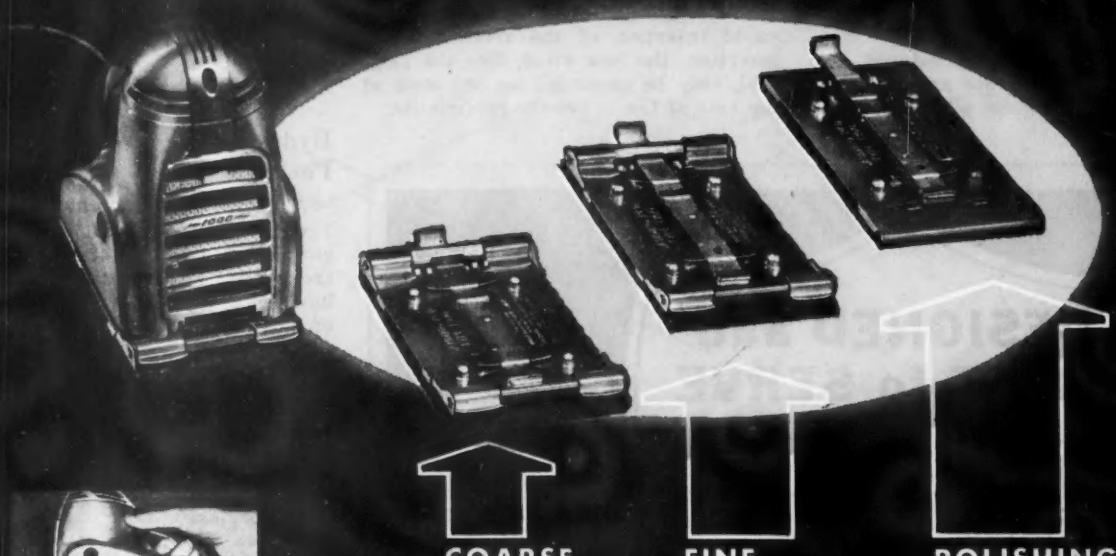
WRITE FOR DETAILED INFORMATION AND CATALOG so that Arens engineers can give your particular problem study and recommendations. The selection of the right control for the job will insure long lasting satisfaction.

This locking type head is designed for use with manual remote controls—permits locking to any desired position. Will not slip.

A vernier type head which permits coarse and micro-fine adjustments by movement of one control head. Cannot slip-always in mesh.

ARENS CONTROLS, INC.
2256 South Halsted Street, Chicago, Illinois

READY FOR ALL TYPES OF SANDING . . .



COARSE SANDING

FINE SANDING*

POLISHING—LAPPING

Load up different grades of abrasives in advance on detachable sanding pad . . . interchange them as needed! It's fast and easy! Sanding operations go on uninterrupted!

Detachable sanding pad feature is only one of the many Sterling Sander advantages! Orbital motion of the pad forces abrasive grits against the work at a speed of 5000 oscillations per minute . . . an action that assures faster, more precise sanding.

This electric portable sander is vibrationless, light in weight and easy to operate. Pad design eliminates any possibility of gouging or marring. On wood, metals or plastics —a smoother job is certain!

Write for new Sterling booklet, "Orbital Motion"—just off the press!

STERLING

1000 ELECTRIC PORTABLE SANDER

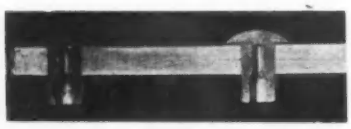
*Sterling sanding produces a more uniform surface than hand or ordinary machine sanding!

For air-driven sanding ask about the Sterling Speed-Bloc Sander!

STERLING TOOL PRODUCTS CO.

385 EAST OHIO STREET • CHICAGO 11, ILLINOIS

Los Angeles and Toronto

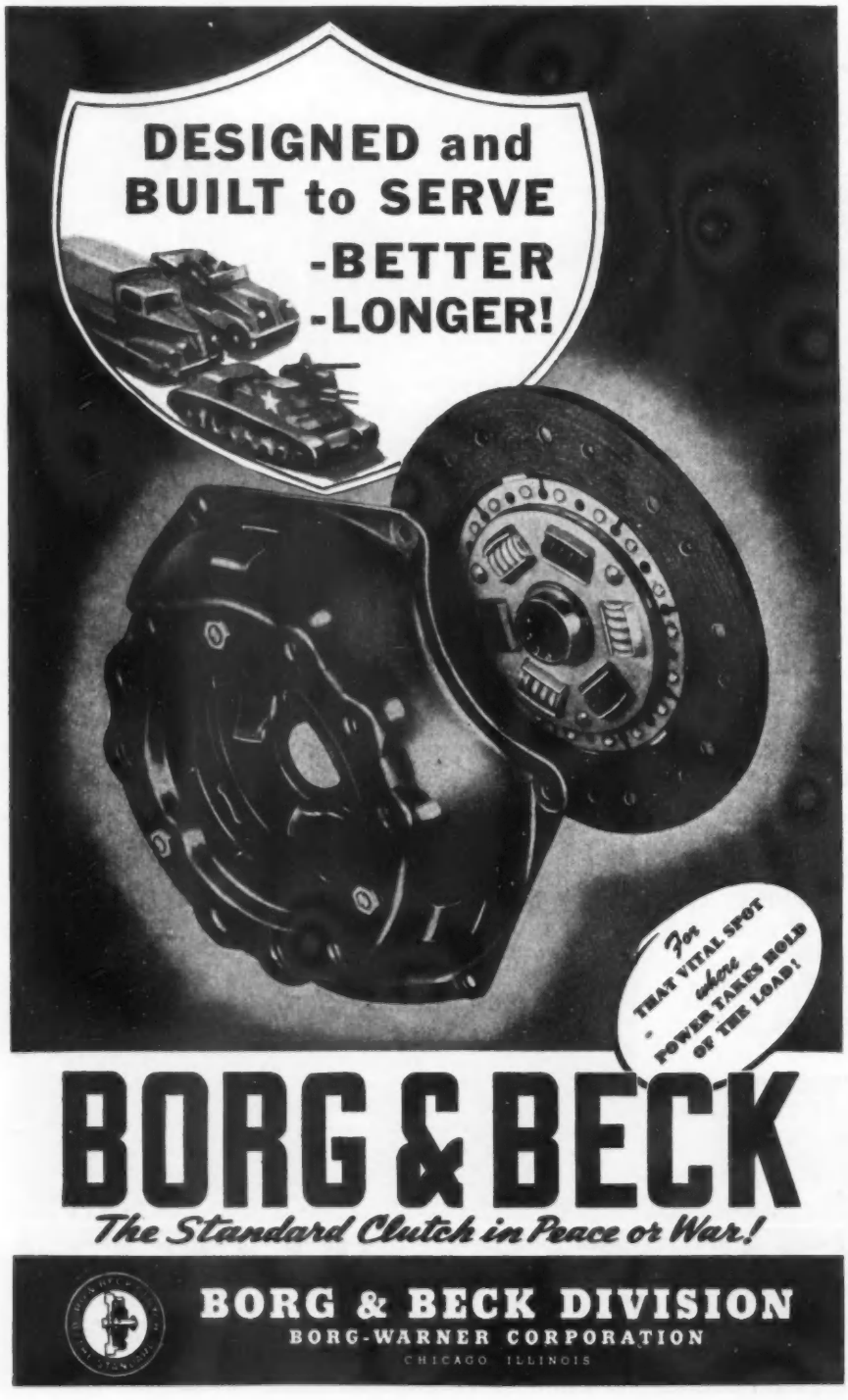


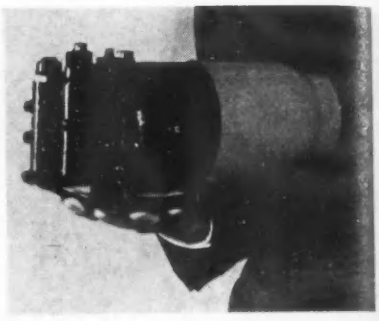
Du Pont explosive rivet

a tiny explosive charge. This is said to be a marked improvement over the original explosive rivet produced by the duPont company and now used extensively in the aircraft industry.

The original rivet, introduced two years ago, was expanded at the end of the shank to lock it in place. Improvement of the rivet, made of aluminum alloy, was accomplished by embodying in it a small auxiliary explosive cavity and modifying slightly the explosive charge. The auxiliary cavity extends from the main chamber in the shank toward the head of the rivet. Detonation of the charge expands virtually the entire shank. Thus an exact fit between the drilled hole and the shank is no longer required.

This leeway makes possible more rapid insertion of the rivets. After insertion, the new rivet, like the original, may be expanded by one man at the rate of ten to twenty per minute.





Pesco hydraulic power package unit

Hydraulic Power Package Unit

A device just brought out by Pesco Products Co., Cleveland, Ohio, is said to simplify and lighten the hydraulic control system for actuation of wing flaps, landing wheels, and other mechanisms of large cargo and transport planes.

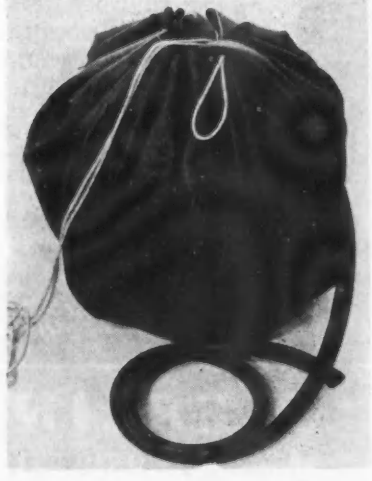
The new device is a so-called power package unit weighing eight pounds, which combines a reservoir, an electrically driven pump, a pressure relief valve and a pressure switch. By its adoption the number of units in the plane's hydraulic control system is reduced to three, from the conventional six, seven or nine. Advantages claimed are considerable weight reduction, economies in installation and service, and longer service life.

Because the power package unit may be installed close to the hydraulic cylinder, long lines for the transmission of hydraulic power are eliminated.

Collapsible Aircraft Cargo Containers

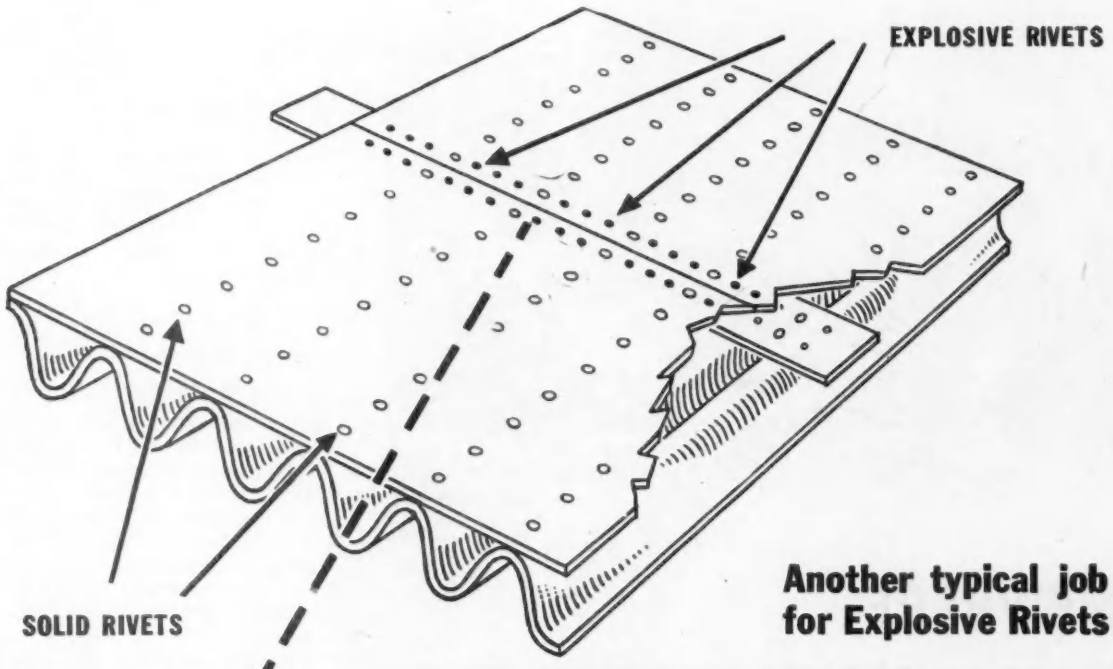
Dangerous corrosive acids such as hydrofluoric, and a wide variety of solvents may now be transported in collapsible emergency aircraft cargo containers as a result of further development by United States Rubber Company, New York, N. Y., of synthetic products.

These containers are made in flex-

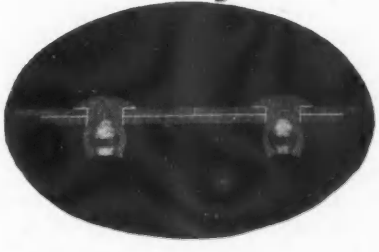


Collapsible container developed by United States Rubber Co.

SPLICING WING SKIN OVER CORRUGATIONS...*RAPIDLY*



Another typical job for Explosive Rivets

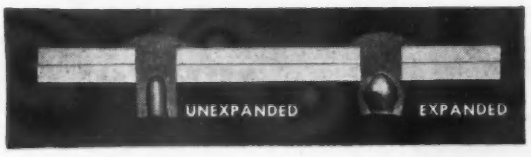


WHEN wing skins riveted to corrugations are spliced, the quickest and easiest way to do the job is with Du Pont Explosive Rivets.

Du Pont Explosive Rivets greatly simplify this operation . . . *help speed it up.*

The rivets are placed in drilled holes. The tip of an electrically heated Du Pont Riveting Iron is applied to the rivet head. This fires a tiny charge in the shank of the rivet, forming a strong, barrel-shaped blind head that firmly sets the rivet in place. And the one-piece shank results in the nearest thing to a solid rivet.

It's fast . . . and one operator can easily do it. Find out about time-saving Du Pont Explosive Rivets now. Millions of them are used on production lines and for maintenance and repair work in leading plants. Write E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, 5494 Nemours Bldg., Wilmington, Del. —5-238 General Motors Bldg., Detroit, Mich.—5801 South Broadway, Los Angeles, Calif.



DU PONT
REG. U. S. PAT. OFF.

EXPLOSIVE RIVETS

The one-piece blind fastener with a solid shank

● This is the story of one of the many contacts made by Square D Field Engineers which have resulted in increased production or reduced costs.

SOMEWHERE . . .
these trucks are on active duty

● What we're proud of, is this—they got into active duty *sooner*, because of a Square D Field Engineer. Here's the story—

Among the machine tools used by the New Brunswick, N. J. plant of Mack Trucks, Inc. was one which automatically drilled and reamed four positions of the rear end housing, in a special sequence. Production could be increased if the electrical equipment which controlled this sequence could be redesigned. Normally, the manufacturer would have referred the problem to the mid-western builder who had designed the machine tool. But time was precious. A Square D Field Engineer was called in. He tackled the complicated job on the spot—had the machine in operation on the speeded-up basis, the second day.

Let a Square D Field Engineer Help You

In the face of today's manpower shortage, peak efficiency of your electrical control and distribution systems is vital. It will be equally important in the highly competitive and narrow-margin years ahead. Now is the time to profit most by the counsel of your nearest Square D Field Engineer. This service is available through Square D branch offices in nearly 50 principal U. S. and Canadian cities.

ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

ible disk form and measure 56 in. in diameter. They are assembled in two parts in sheet form. One is a light cotton fabric which is treated with vinylite. The other is coated with synthetic rubber. They are held together with small eyelets spaced about 3 in. apart which are stapled into the material. A light-weight cord is drawn through the eyelets. The completed article is then ready to be placed around either a glass or metal container and drawn tight, much as a tobacco pouch, to insure against spillage on any part of the plane.

Should breakage occur or the caps of the containers become loosened owing to vibration, and the acids now spill into the emergency wrapping. A flexible hose is inserted into a rubber disk which is placed into the top of the container before the draw strings are tightened. The acid fumes are carried off through this tube, thereby dispelling any possibility of damage from fumes or liquid.

Textile Made of Glass and Asbestos

A new textile made by combining glass and asbestos fibers is being employed as a protective boot in war planes. In fabric form it is used for gum boots, tail-wheel boots, and—in the P-47 Thunderbolt—to protect retractable landing gear from the hot exhaust of the supercharger. In cord form the textile is used for shroud lines on military flares.

The glass-asbestos textile is intended for applications requiring high strength combined with light wieght, high abrasion resistance, and resistance to high temperatures and corrosive fumes. In textile terms, the combination glass-asbestos cloth may be classified as an inorganic canvas or duck.

The textile is made either by combining glass and asbestos fibers to form yarns, or by combining glass and asbestos yarns in the weaving operation. The high strength of the material is primarily due to the glass, while the asbestos increases abrasion resistance.

Applications to date point to many possibilities for the use of the new textile, but because of limited production it can be supplied only under a high priority or end-use rating. The textile is being supplied by Owens-Corning Fiberglas Corporation.

WAR BONDS

continue to sell

ARE YOU STILL BUYING?

with clutch segments of **N-A-X HIGH TENSILE**

When the Axis moves out, these big compressors move in. Overworked, at high speed, under the very worst conditions, they furnish vital air for divers' equipment and pontoons, as well as for drills and other tools used in salvage work. Pearl Harbor, Bizerte, Salerno and other ports were all quickly cleaned for Allied service with their help.

At the heart of these compressors are clutch segments of N-A-X HIGH TENSILE STEEL. The great strength of N-A-X HIGH TENSILE, its high resistance to fatigue and impact even at sub-zero temperatures, its excellent welding qualities, its unusual ductility and its easy formability have made it the preferred selection of scores of war equipment manufacturers. It's a steel, too, with an assured future for the products of our peacetime world. Write for the new booklet on N-A-X HIGH TENSILE and N-A-X 9100 SERIES STEELS.

GREAT LAKES STEEL CORPORATION

DETROIT, MICHIGAN

Sales Offices in Principal Cities

Division of **NATIONAL STEEL CORPORATION** *Executive Offices, Pittsburgh, Pa.*

DUCTILITY — ITS INHERENTLY FINER GRAIN MAKES ALL THE DIFFERENCE — STRENGTH

J-7668

Solve Rivet Control

(*Continued from page 32*)

floors. For this purpose two delivery racks were designed which could be placed on a pony truck. Each rack has a capacity of 15,000 bags hung on 14-inch pins attached to either side of the rack. There are 250 pins to a side with each one capable of holding 30 bags. One side of the rack is used for the countersunk head and the other for universal head rivets.

The mobile delivery racks are loaded in the Rivet Packaging Area, then placed on a pony truck and circulated throughout the plant to service the various rivet stations. Use of the two racks is alternated so that while one is out on delivery the other is being loaded in the Rivet Area, thus assuring a continuous flow at all times.

Transfer of the packaged rivets from the delivery to the station racks is a simple procedure. The operator merely secures the number of bags required, pinches them between his fingers close to the punched hole, removes them keeping the holes in the bags aligned by the pinching action, and placed them on hooks on the rivet station boards. The mobile delivery racks follow a regular route, and all rivet station racks are replenished in regular rotation.

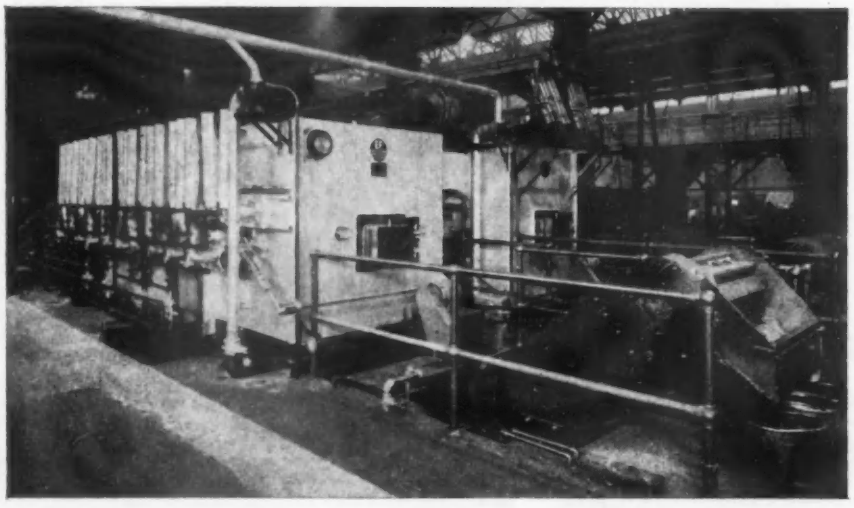
Under the centralized set-up all cellophane packaged rivets used by the Army and Canton Divisions are also serviced from the Plant 1 Rivet Packaging Area. Each day the leaders in charge of the Rivet Stock Area in these two divisions prepare lists of what is needed at that particular plant, and forward them to Plant 1. The packaged rivets so requisitioned are loaded into special inter-plant rivet delivery trucks which are locked against tampering. These trucks are picked up by the Transportation Department at regularly scheduled intervals. As in the case of the in-plant delivery racks, two of these trucks are used for each plant so serviced so that one can be loaded while the other is in transit. After delivery to the Division Rivet Stock Area, the rivets are serviced to the various stations in the same manner as at Plant 1. Thus a unified control is kept on flow at all times.

The third phase of the rivet handling program covers the return and conservation of loose rivets and partially used bags. At each rivet station rack rivet boxes are provided to receive these loose rivets and partially used bags. Return rivet boxes from all plants are delivered daily to the Central Rivet Packaging Area, where they are emptied by a sorting group and sorted.

All returned partially used rivet bags are carefully inspected before their contents are returned to bulk stock, and if dirty or mixed rivet content is found, they are turned over to the Conservation Department for cleaning and sorting. All loose rivets are likewise sent to the Conservation Department for cleaning and sorting, but are first bagged and weighed in the Packaging Area. In the Conservation Department mixed, dirty and loose rivets are passed through the mechanical processes formerly used with bulk rivets, and then returned to the Central Packaging Area where they receive the same treatment as new stock.

The use of these new methods of rivet control based on cellophane packaging and centralized distribution has made itself felt in many ways. Floor swept rivets have decreased tremendously, and dirty and crushed rivets have been almost entirely eliminated. Cleaning and sorting machine time has been reduced 50 per cent, with the same number of machines that formerly operated night and day now handling salvage operations for all plants in one shift.

Similar improvements have been made in the handling of DD or Icebox rivets. Today, the entire heat-treating system for these rivets has been placed



EF Gas Fired Radiant Tube Chain Belt Conveyor Furnaces

For Scale-Free Hardening Miscellaneous Products 300 to 1700 lbs. per hour—continuously

The above gas fired radiant tube furnace is one of three chain belt conveyor type furnaces we installed in one prominent midwestern plant for scale-free hardening small and medium size products. These continuous chain belt conveyor furnaces may be oil fired, gas fired or electrically heated. They are built in 5 standard sizes with capacities ranging from 300 to 1700 lbs. per hour. Larger or smaller sizes can also be supplied. Any size or type can be furnished for using special protective atmospheres for heat treating without scale or decarburization.

Products being treated in EF Chain Belt Furnaces include:

Sprockets
Cap Screws
Bolts and Nuts
Gears and Pinions
Flat and Coil Springs
Small Forgings
Valve Springs
Spring Plates
Tractor Links
Automotive Parts
Wrench & Tool Parts
Rivets and Washers
Bearing Parts
—cups and cones
Machine Gun
Cartridge Clips
Aircraft Engine Parts
Rock Bits, etc.

EF Chain Belt furnaces are handling all kinds of parts and products ranging in size from small bolts and springs up to large crawler links for tanks and tractors. Hundreds of these furnaces are in operation handling such products as listed at left. The conveyor type furnace is one of the most satisfactory and dependable general purpose heat treating machines built for the continuous, uniform, economical, production heat treatment of miscellaneous small and medium sized parts and products.

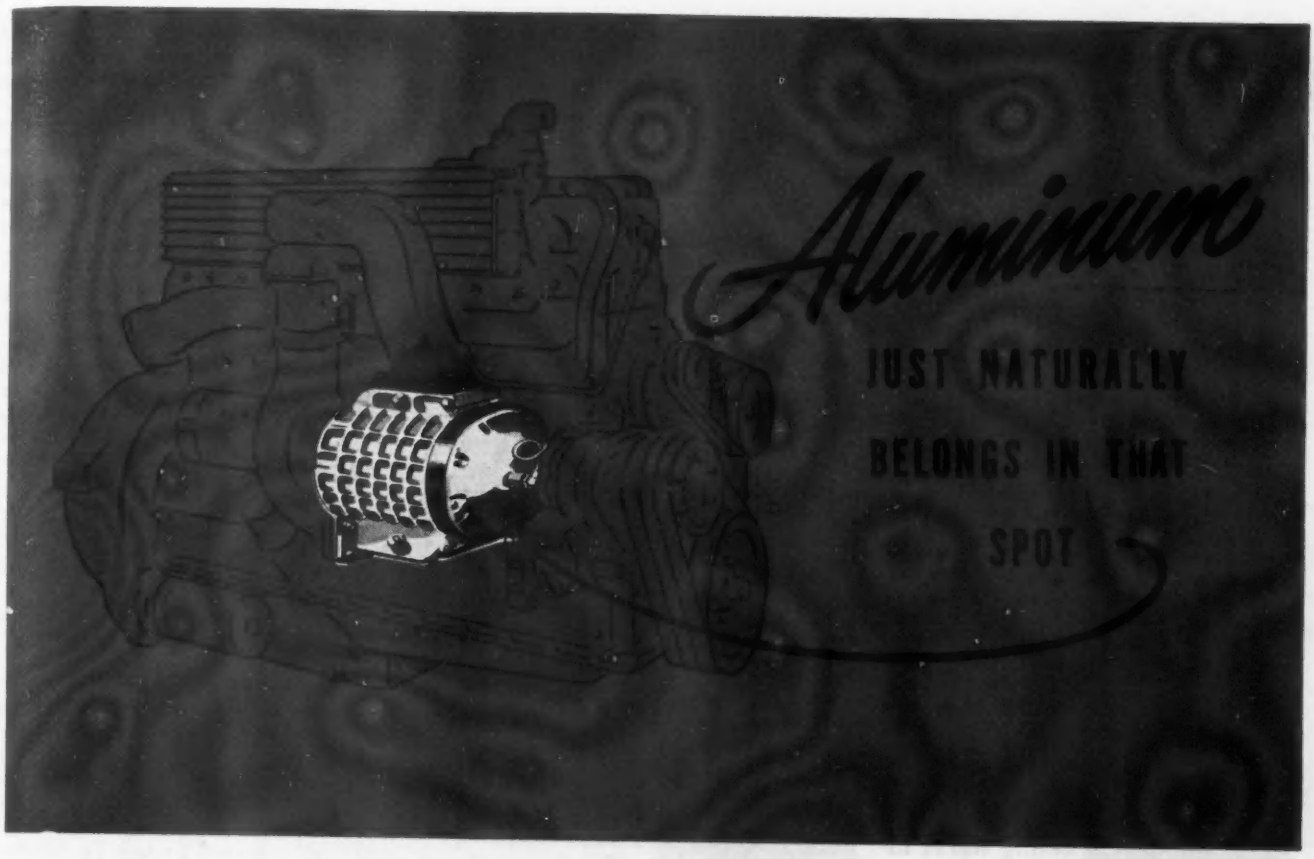
The chain belt conveyor furnace is only one of the numerous types we build. Castings, forgings, stampings, aircraft and aircraft engine parts, tank and truck parts, tubing, wire, strip, and many other products are being uniformly treated in other types of production furnaces we have built.

Telephone 4661 Salem, Ohio, or write us regarding your furnace problems. We specialize on building production furnaces—oil fired, gas fired, or electrically heated.

Send for circulars showing the chain belt and other types of EF production furnaces.

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production



Superchargers, on small engines or large, need the properties which aluminum offers. The superior heat conductivity of aluminum results in air being delivered cooler, increasing supercharging efficiency. Aluminum helps hold the weight of this important accessory to a minimum.

It's the familiar story that aluminum helps crowd more power into each cubic foot of engine and each pound of total weight. This is a fact proved before the war on many types of Diesel engines, and being confirmed today on Diesels used in war equipment and on every airplane engine using a supercharger.

Advantages gained by employing aluminum in superchargers are duplicated at many other points in Diesel engines. Pistons and cylinder heads, because of aluminum's superior heat distributing property, provide better cooling and higher output. Reciprocating parts have lower inertia, when made of aluminum, and all parts weigh less.

Alcoa engineers are prepared to consult with manufacturers regarding the right alloys, the right forms of aluminum and the right applications that will produce finer, more economical and longer-lived engines. Write ALUMINUM COMPANY OF AMERICA, 2110 Gulf Building, Pittsburgh 19, Pa.

ALCOA
ALUMINUM
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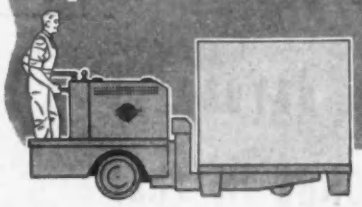
Alcoa Research Helps you Employ

Aluminum's High Heat Conductivity

ALCOA
ALUMINUM

IS YOUR PROBLEM ONE OF *Speeding Carloading or Unloading?*

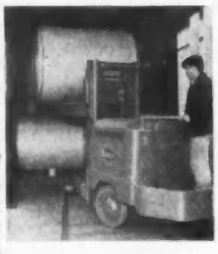


Industrial Trucks have revolutionized carloading and unloading methods. Our files contain hundreds of case histories in which Baker Trucks have reduced time, cost and manpower on these operations to a fraction of former requirements. A few typical installations are described below.

★ ★ ★

Baker Low Lift Trucks load and unload forged parts, castings and other materials on skids—eliminating individual handling of pieces. In many cases shipment is made on skids, enabling trucks to also save time at receiving end. Illustration shows skid-load of zinc pigs being loaded into a box car.

Equipped with telescoping uprights a Baker Hy-Lift Truck can enter a box-car door with ease, and tier material inside the car, conserving shipping space. (See illustration). Actual savings in costs of loading and unloading operations with Baker Trucks have been reported as high as 75% over former methods.



Where material lends itself to shipment on wooden pallets, Baker Fork Trucks can greatly reduce time and cost of loading and unloading. One Company reports savings of 25c per ton, or $12.50 per car—at the same time releasing seven men for other work. This procedure is called "Unit Handling."*

Baker Crane Trucks have solved many difficult loading problems, where heavy, bulky parts or materials are to be shipped on gondola or flat cars. Illustration shows a crane truck with a large hook making quick work of loading heavy coils of wire at a wire mill.

A large aircraft manufacturer uses Baker Hy-Lift Trucks to unload crated airplane engines weighing 2100 pounds from the boxcar in which they are shipped. One operator with a truck transports the engines either to storage, or to the assembly line—relieving a number of men for other duties.

Highway-truck loading with Baker Fork or Hy-Lift Truck requires no loading platform. Sacks of bulk materials may be handled or shipped on pallets, eliminating the need for individual handling, and permitting tiering of material in warehouse or carrier.

** A bulletin "Unit Loads—Their Handling, Shipment and Storage" has just been published by the Industrial Truck Statistical Association. A copy will be mailed upon request.*

WRITE FOR YOUR COPY

Plant and production managers, traffic managers, superintendents, purchasing agents and any others concerned with material handling will find the new Baker Catalog No. 52 a valuable reference.

BAKER INDUSTRIAL TRUCK DIVISION

of The Baker-Raulang Company

2154 WEST 25th STREET • CLEVELAND, OHIO

In Canada: Railway and Power Engineering Corporation, Ltd.

on an automatic basis. Traveling, self-locating, electric hoists pick up containers loaded with these rivets from electric air furnaces, deposit them in the various baths, and finally into a storage freezer. From here they are transferred to a mobile ice box, cooled with dry ice, and delivered to electrically-cooled rivet station ice boxes with a mean low temperature of minus 50 F to minus 60 F.

By itself, the rivet is a very small item, but considered collectively it is a major item in current warplane production; and proper methods for its control and handling can result in important savings of man and machine hours. At least, that has been the experience of The Glenn L. Martin Co.

New Boeing Wind Tunnel

(*Continued from page* 19)

atop the tunnel building and is used for the intake and exhaust of this air.

An aerodynamics laboratory adjoins the wind tunnel, with a reception lobby and model building shops on the first floor and engineering offices and tunnel operations room on the second. An overhead monorail system is provided to transport models from the construction shops through the operations room and into the test section, where the pressure cap is completely removable to permit ease of installation. Disassembly of models is not required.

The tunnel is sound-proofed throughout and even its highest speed operation is scarcely audible in adjoining quarters. This is due in part to the fact that the tunnel bore is built with thick concrete walls.

Pratt & Whitney Engine Production

Last of the new aircraft engine plants to get into production, the 57-acre establishment of Pratt & Whitney Aircraft Corp. of Missouri at Kansas City, Mo., is now turning out the new Double Wasp R-2,800-C engine. The new engine develops opwards of 2,100-hp. The new plant has half of the peak employment of 29,000 workers on the job and 45 per cent of the present employes are women.

Pratt & Whitney engines developing more than 250,000,000 hp. were produced by United Aircraft Corp. and its licensees in 1943. The latter include Buick, Chevrolet, Ford, Nash-Kelvinator, Jacobs Aircraft Engine Co. and Continental Aviation & Engineering Corp. The new Kansas City plant will be United Aircraft's largest engine-making unit.

More than half of all advanced training and combat aircraft engines produced in the U. S. in 1943 were of Pratt & Whitney design.

IT TAKES A BEATING WITH A SMILE!

● Here's the interior trim which creates that clean, crisp, up-to-the-minute impression so important in bringing people, especially women, to the show rooms of your dealers—Formica decorative sheet.

For Formica's beautiful to look upon. The warmth of its colors . . . available in many shades to harmonize with any decorative scheme—is a delight to the eye.

But what is even more important—Formica is as practical as it is attractive. Protected by a hard, deep surface finish, Formica can easily be washed and polished and kept new in appearance for years and years. Formica is non-absorbent and resistant to dirt, grease, grime, scuffing and wear. It takes a beating with a smile.

Specify Formica for the interior of your doors, back of the front seat, front of the back seat and other surfaces on the interior of your car. Write for full details today.

"The Formica Story" is a moving picture in color showing the qualities of Formica, how it is made, how it is used. Available for meetings of engineers and business groups.

THE FORMICA INSULATION COMPANY
4612 Spring Grove Avenue
Cincinnati, Ohio

FORMICA

Emphasis on Super-Bombers

(*Continued from page* 46)

1940. These include both Rolls-Royce Merlin aircraft engines, of which nearly 28,000 had been produced up to last Jan. 1, and Packard marine engines.

Ford also has built 25,000 turbo-superchargers in the last 18 months. These are General Electric-designed superchargers for installation in B-17 and B-24 bombers. Ford engineers converted automobile body presses to the manufacture of steel stampings for the supercharger compressor box. Originally made of cast aluminum, this box was redesigned to use low carbon steel. The stampings are spot and seam welded into a compact assembly. Electric arc welding equipment was taken from former automobile lines and used to butt end weld the bucket wheel to the supercharger shaft, replacing three bolts. The welded job is stronger as well as lighter. Nearly 1,000,000 pounds of aluminum was saved at a time when aluminum was critical by redesigning certain parts, such as the compressor box.

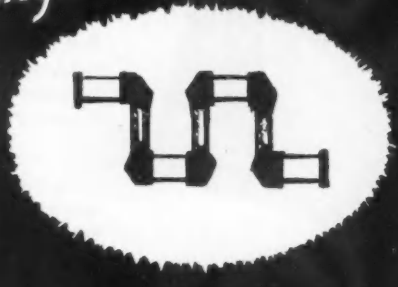
Aircraft production in April totaled 8,343 planes, according to C. E. Wilson, chairman of the Aircraft Production Board. This 9 per cent drop from March's record output of 9,117 planes had been anticipated, however, by Wilson when he previously announced that production would decline in total numbers but increase in airframe weight due to a growing emphasis on heavier planes like the B-29 and other 4-engine planes. It also was revealed that the 1944 munitions program of $74 billion will be 36 per cent aircraft, according to March 1 estimates by the Army and Navy. The other programs include: shipbuilding, 22 per cent; combat vehicles, 8 per cent; ammunition, 7 per cent; guns and fire control equipment, 5 per cent; electronics and communication equipment, 4 per cent, and other items and supplies, 18 per cent. The general production curve will reach its high point in mid-October, according to the government charts, with a slight decline continuing for the rest of the year. These charts are based on the premise that Germany will not be defeated this year. A sudden cessation of the European conflict would alter the outlook considerably. Wilson estimated that 35 per cent of the nation's productive capacity now working on war products would be made available for civilian goods after the defeat of Germany.

Total war production in March advanced 3 per cent over February, the WPB munitions index rising to 660 (November, 1941, equals 100), only two points below the peak reached last December. Heavy military truck production increased 13 per cent in March, while the amphibian "ducks" gained 17 per cent. Tractor output, which is accelerating, equalled schedules. Combat vehicle production advanced 9 per cent due to a big rise in tank output. Important design changes are taking place in the tank program. Self-propelled gun carriages declined 15 per cent instead of 20 per cent as scheduled. Landing craft, for which the automotive industry produces most of the Diesel engines, increased 26 per cent over February.

Buick is retooling and renovating its gray iron foundry at Flint to supply cylinder block and cylinder head castings to Hercules Motors Corp. for military trucks. Much of the foundry had been converted for aluminum castings for Buick and other aircraft engine manufacturers. This will be moved to other facilities that have been made available. With the reconversion of the Ordnance Dept. ammunition program from steel back to brass shell casings, Buick has ceased production of the steel cases. Corcoran-Brown Lamp Division of Electric Auto-Lite Co., which also was manufacturing the steel casings at Cincinnati, has converted to the brass variety. Reduction in the small arms ammunition program, with a consequent availability of brass, made the Ordnance Dept. switch possible.

INDIUM

The Final Touch in Making Superior Engine Bearings



It's amazing what a minutely thin film of Indium plated onto and diffused into the bearing metal can do to increase bearing life . . . and by increase we mean doubling or trebling the number of hours the bearing can stay in service. It's amazing, too, the way Indium can be used to rejuvenate worn bearings.

Indium, diffused into the contact surface, produces an exceptionally high wear-resistance and corrosion-resistance, without interfering with proper lubrication. Bearings for all types of engines—aviation, bus and truck, Diesel—are benefited.

If you are having trouble with bearings, write us in detail. Perhaps our engineers can suggest ways by which the application of Indium can correct it.

ARMY E NAVY

INDIUM CORPORATION OF AMERICA

Pioneer 40

THE INDIUM CORPORATION OF AMERICA

UTICA, N. Y.

New York Office: 60 East 42nd Street, New York 17, N. Y.

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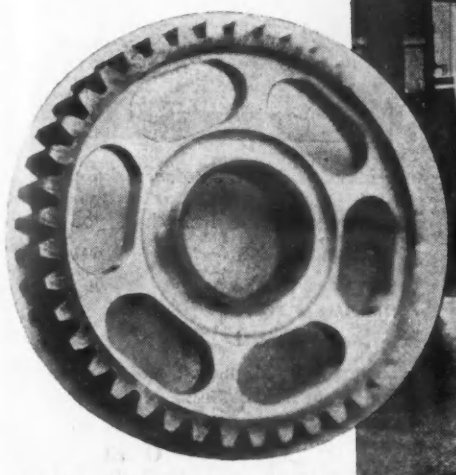


Quality which protects the lives of men and the success of warplane missions is Homo-carburized into gears such as these by the Perkins Gear & Machine Co., Springfield, Mass.

With automatic control of heat-treating variables this giant battery of Homocarb and Homo Tempering Furnaces is ideally suited to the high-quality heat-treatment needs of the Perkins organization.

CARBURIZING HAS JOINED THE PRECISE METHODS OF MASS-PRODUCTION

Gears are carburized as accurately as they are machined, in the immense plant from which Perkins Gear & Machine Co. is now pouring out airplane-engine parts by the scores of tons. The heat-treat operators are giving these gears carburized "cases" which are uniform to within less than a thousandth of an inch; and this thickness can be changed, accurately and at will, as steel analyses require. The case is uniform in hardness as well as thickness. Carburizing has joined the precision tools of mass-production and is more than holding its own against the high standards set by the airplane-engine industry.

Even though you carburize in pounds rather than tons, the same automatic controls which enable the Homocarb Method to do such uniform work for Perkins will apply with the same effect in your plant. These controls are:

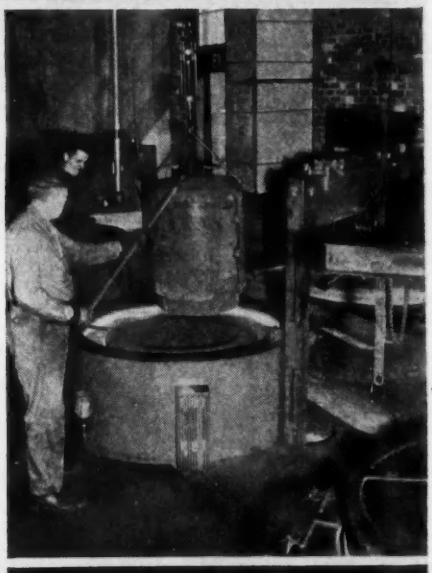
1. Uniform quality of carbon source; the Homocarb Fluid employed is a laboratory-controlled product which creates a gas of unvarying richness.

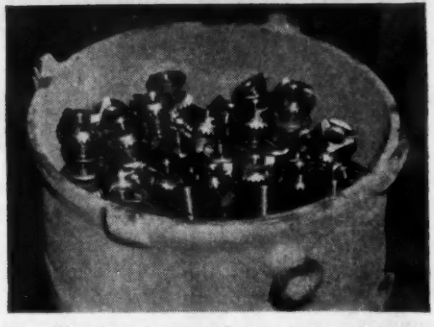
2. The amount of carbon is accurately controlled by a high-grade injector pump, which feeds Homocarb Fluid to the Furnace in precisely the amount desired by the operator.

3. Temperature is automatically regulated by a Micromax Pyrometer —recognized everywhere for championship dependability and accuracy in temperature control.

4. Duration of carburizing is known exactly, because the uniformity of heating (by the Homo forced-convection method) brings the entire furnace charge to soak temperature at the same time. This of course is just another angle of uniformity, which is Homocarb's great over-all contribution to the process of carburizing.

If you have a carburizing, gas-cyaniding, nitriding or tempering problem, kindly outline it and an L&N engineer will either see you about it, or send literature, as you prefer.





Top—Note ingenious combination hook and shield used by Perkins for loading and unloading Homocarb Furnaces. Bottom—Typical load for Homocarb Furnace may contain several kinds of Perkins gears and similar parts.

Jrl Ad T-623(18)

A Slogan For Every American

LEEDS & NORTHRUP COMPANY, 4966 STENTON AVE., PHILA. 44, PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

New Products

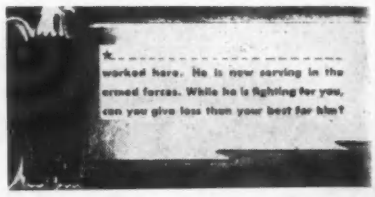
(*Continued from page* 63)

during the first ten minutes of milling at high temperature. But upon further milling this stiffening effect disappears.

When the R.P.A. No. 5 is added, to the extent of two per cent, this period of stubborn stiffness disappears and the synthetic begins to soften up properly as soon as the milling is started. Furthermore, instead of higher temperatures decreasing the workability, they speed up the processing when the plasticizer is added.

Sticker Stresses Need of Greater Production

A sticker which stresses in the minds of employees the need of greater production has been designed by Avery Adhesives, Los Angeles, Cal. This new sticker is placed upon desks, machines, or work benches where men now in the armed forces formerly worked. The sticker reads: "_____ worked here. He is now serving in the armed forces. While he is fighting for you can you give less than your best for him?"



Sticker designed by Avery Adhesives

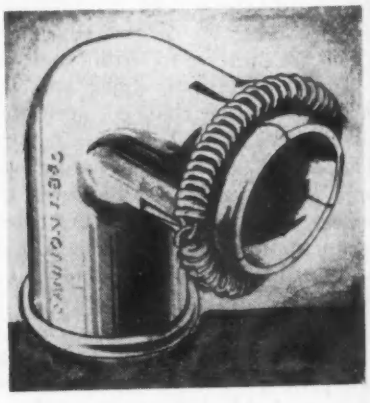
Asbestos Product Replaces Metal

Practically all metal has been eliminated from heating and ventilating air-duct systems of aircraft by the discovery and development by United States Rubber Company, New York, N. Y., of a fire-resistant asbestos product. Items made with these less critical ingredients will replace aluminum and other metals. Construction is such that should this multiflex be penetrated by bullets or aerial flak, it can be easily and speedily repaired, as there is no flare in the material after the projectile passes through the duct.

Made of fabric, asbestos and a synthetic coating of resin, this new product makes possible the lightening of the material used on these heating and ventilating air-duct systems by more than 10 per cent.

Vent Elbow for G-I Batteries

Cannon Electric Development Company, Los Angeles, Cal., has just brought out a battery vent elbow, No. 11840, adaptable to G-I batteries conforming to AN-W-C-141 specifications. It is made of black polystyrene and has a collar spring of phosphor bronze. The elbow has three split sections to give it sufficient elasticity to slip over the vent.



Cannon battery vent elbow

Invisible Glove

A smooth, white cream that disappears into the skin to form an invisible glove which prevents the penetration of grease, paint, and dirt into the pores,

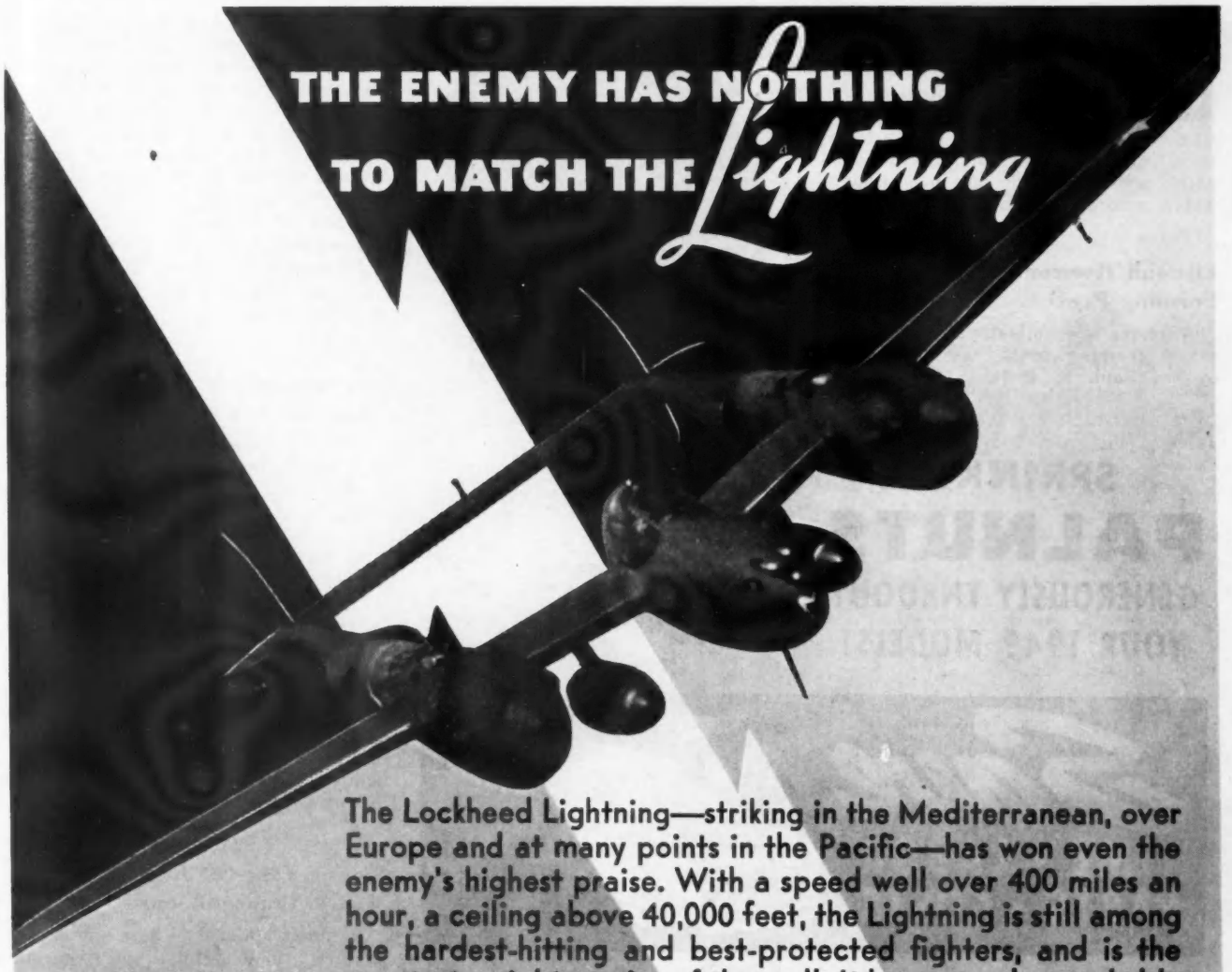
You can accurately measure applied torque in *inch ounces, inch pounds* or foot pounds, with STURTEVANT Torque Wrenches as they are built in all capacities from 0-40 inch ounces up to 600 foot pounds or 7200 inch pounds.

Over 100 models and types.

Each is a permanently accurate tool.

Write for Bulletin TW-13

THE ENEMY HAS NOTHING TO MATCH THE *Lightning*



The Lockheed Lightning—striking in the Mediterranean, over Europe and at many points in the Pacific—has won even the enemy's highest praise. With a speed well over 400 miles an hour, a ceiling above 40,000 feet, the Lightning is still among the hardest-hitting and best-protected fighters, and is the greatest weight carrier of them all. It has proved remarkably versatile as a high altitude fighter, a low-level and dive bomber and a deadly strafer. Deliveries to many fronts have been attained by increasing its range until it can be ferried anywhere. And it can take punishment like an American heavy bomber. In the Aleutians, a pilot flew his Lightning back to the base with one engine completely shot away.

Part of the Lightning's weight is armor for safeguarding the pilot and vital parts; much of it is sturdy airframe construction, with maximum ease of replacement.

To the staunch airframes of the Lightning and many other outstanding American planes, strength and the ability to take abusive punishment is contributed by the tough, stress resistant drop forgings which Kropp Forge Aviation is producing in ever increasing volume. We produce airframe drop forgings exclusively for most major airframe builders—may we serve you?

Member of the A.C.C.A.

Kropp Forge Aviation Co.

5301 W. ROOSEVELT ROAD CHICAGO

Engineering Representatives in Principal Cities

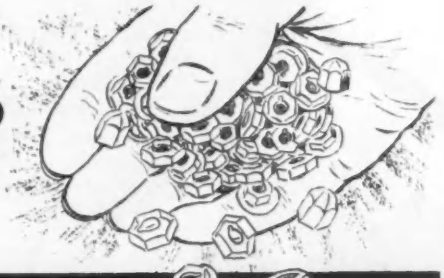
is a new development announced by Turco Products, Inc., Los Angeles, Cal. Solu-Gluv is used much like vanishing cream. When it dries it forms an invisible film to which grease, paint, cutting oils and dirt adhere. At wash-up time, invisible glove, dirt, grease and paint are all rinsed off in ordinary water, according to the maker's claims.

Five-ton Horizontal Forming Press

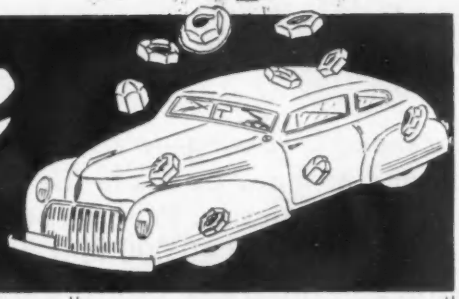
A unique hydraulically actuated horizontal forming press has been built by the John S. Barnes Corporation, Rockford, Ill. Features of this 5-ton press include safety dual push button control and smooth, precise fluid power. Hydraulic fluid moves the ram forward at the rate of 45 in. per minute and returns it at a speed of 90 in. per minute. Maximum pressure of the hydraulic system during forming is 800 psi. The working table is readily accessible and free of unnecessary obstructions. A flange-mounted dial pressure gage on the front of the machine indicates the tonnage exerted by the forming ram.

Barnes horizontal press

SPRINKLE
PALNUTS
GENEROUSLY THRUOUT
YOUR 194? MODELS!



Save
TIME • LABOR
PARTS • COSTS



The more Self-Locking PALNUTS you use, the more you save and the more secure your fastenings. A single, inexpensive PALNUT can be used in place of jam nut — lockwasher and nut — plain washer, lockwasher and nut, saving 60% to 90% in weight, reducing space, cutting assembly time and labor up to 50%.

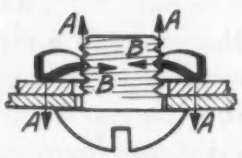
Self-Locking PALNUTS are single thread, spring tempered steel locknuts, which exert a powerful double locking action* when tightened. They are light in weight, low in cost, require only 3 bolt threads space, apply easily and speedily with hand or *Power Drivers*. Made in many types for various applications, in wide range of standard sizes. Send details of assembly for samples and data. Write for Palnut Manual No. 2 giving full story, sizes, types, etc.

The PALNUT CO., 60 Cordier St., Irvington 11, N. J.

Vibration-proof
FASTENINGS FOR

Radiator and Trunk Medallions — Glove Compartment Door — Instrument Cluster — License Bracket — Moulding Strips — Engine Coil Mounting — Choke and Throttle Dash Mountings — Instrument Assembly, etc., etc.

*DOUBLE LOCKING ACTION



When the PALNUT is wrench-tightened, its arched, slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt thread and downward on the part (A-A), securely locking both.

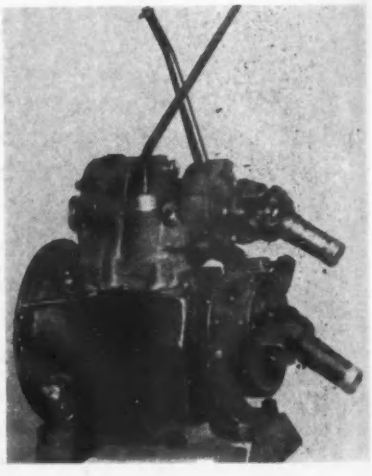
Self-Locking PALNUTS

Accelerator for Quenching Oils

Ordinary quenching oils can be economically stepped up to the performance levels of fast quenching oils by addition of Park Quench Oil Accelerator, a new product of Park Chemical Co., Detroit, Mich., according to the maker's claims. By adding Accelerator in a ratio of one to four to oil already in a system, the viscosity, flash and fire points of the original oil are raised slightly, while cooling rates for steel are increased. While the Accelerator cannot be regarded as a substitute for a new quick action oil, it is said to be an economical means of salvaging oil where a complete change is not desired.

Power Take-Off for Truck Transmissions

What is claimed to be a simple form of power take-off for direct application on truck transmissions has been developed by Anthony Tanger, Detroit, Mich. The unit illustrated is mounted as an integral part of the top structure of a standard transmission. This attachment can be designed to suit requirements.



Tanger power take-off

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It's the hour for invasion! Giant motorized artillery pieces are lumbering off landing barges—rolling over strange roads and hills to blast a path for the advancing forces. Huge ammunition trucks keep pace with the guns. Both are safely controlled—or stopped *instantly*—by Warner Electric Brakes. Dependable in all kinds of weather, these electric brakes are demonstrating advantages of their positive braking under most grueling conditions. When Victory is won, the experience gained in war will be applied to electric brakes for scores of new peacetime uses. Then trains—and many other types of power equipment—will be *braked electrically*—and Warner Electric Brakes will be available for an ever widening range of new power braking applications.

WARNER ELECTRIC BRAKE MFG. CO.
Beloit, Wisconsin

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WARNER
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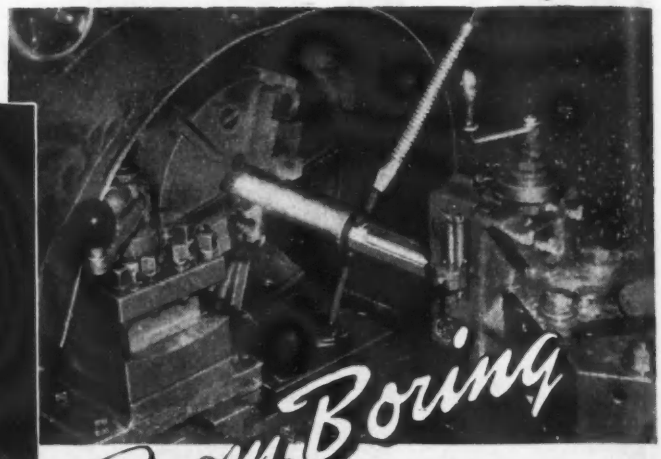
CONTROLLED SPLIT-SECOND STOPPING POWER FOR ANY PURPOSE

Change to Broaching



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A large manufacturer formerly produced hydraulic cylinders for aircraft by boring, grinding and honing. The boring and grinding operations alone required 50 minutes. Now these parts are broached and honed. This method requires 1½ minutes per piece exclusive of the honing. The broaching produces a surface comparable to the ground surface so that both pieces require about the same amount of honing. Thus 48½ minutes are saved on every piece and several turret lathes and grinders, together with their operators, are released for other work.

This is a typical example of the savings in time and cost and the product improvement made possible where Detroit Broach tools and accessories are used. Go over your production plans with a Detroit Broach Company engineer. He may be able to suggest several ways in which broaching can help you gain greater production at lower cost. He will be glad to submit complete cost and production data without obligation to you. Write Detroit Broach Company today.

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Installed with press fit in reamed holes, these bolts—finished to within a total tolerance of .0005—reduce possibility of wear through friction to a minimum.

National's success in producing these bolts in quantity to "NAS" standards, is the result of a series of manufacturing and inspection operations that would be simply unbelievable to the bolt makers of a few years ago.

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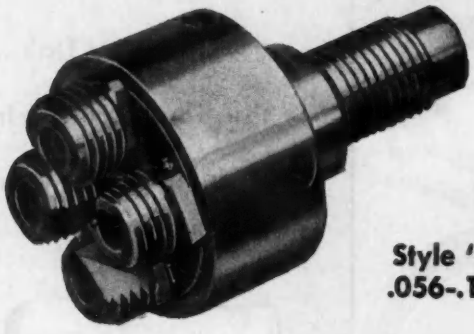
One adjustment brings all chasers to fine diametric precision, and they hold to the rigid standards of Class 3 threads. Chasers may be reground through 270° circumference—they last 20 to 50 times longer.

If you cut small diameter threads, the new "DA" is the tool you need. Catalog D 42-A.



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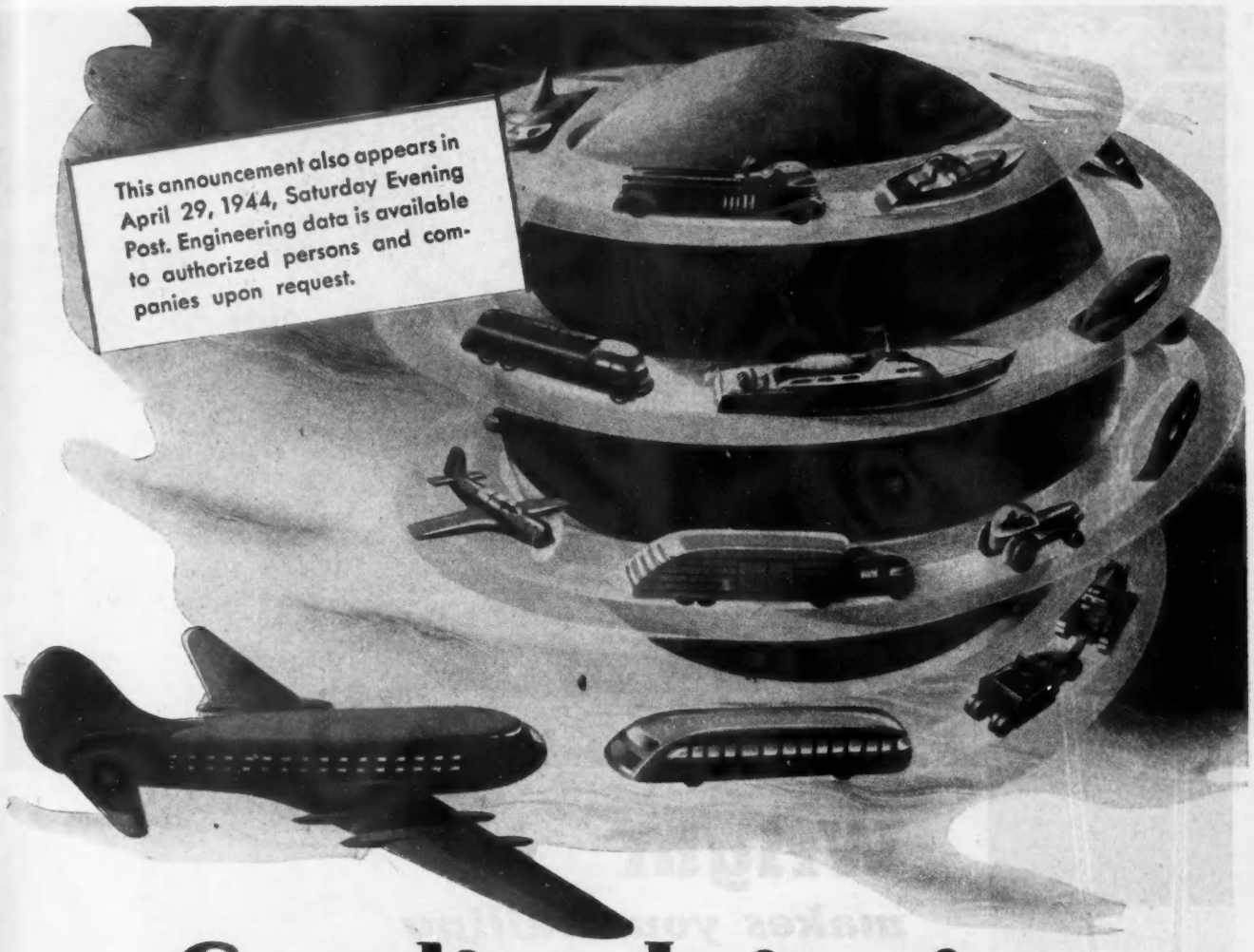
This announcement also appears in April 29, 1944, Saturday Evening Post. Engineering data is available to authorized persons and companies upon request.

Gasoline Injection

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In 1944 gasoline engines enter a new phase of progress as builders start to use American Bosch Gasoline Injection. You will hear of it again and again as we progress through Victory to the world of tomorrow.

WHAT IT IS . . . Briefly—an entirely new and different way of supplying fuel to the cylinders of a gasoline engine.

Important? Yes! Leading engineers knew that it was but a matter of time before a better fuel distribution system would become a practical reality — a system that would increase efficiency and bring extra safety.

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American Bosch knew gasoline engines from years of experience in building ignition equipment. American Bosch knew Diesels. They had engineered and built Fuel Injection Equipment for the American Diesel industry from the inception of high-speed engines.

So American Bosch engineers co-ordinated their own fund of gasoline and Diesel engine knowledge with that of forward-looking engine builders. Test installations followed. They proved a success. Gasoline Injection is today a reality.

WHAT IT DOES . . . *Greater, Smoother Power.* Now, the fuel is delivered uniformly to every cylinder. The result—all cylinders "pull" together in perfect harmony. And because the fuel is vaporized mechanically, all fuels, even lower grades, burn more efficiently, deliver a greater percentage of their potential power in the form of useful energy.

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It's here — *Gasoline Injection.* Its benefits will be yours — for convenience, economy and pleasure — after Victory.

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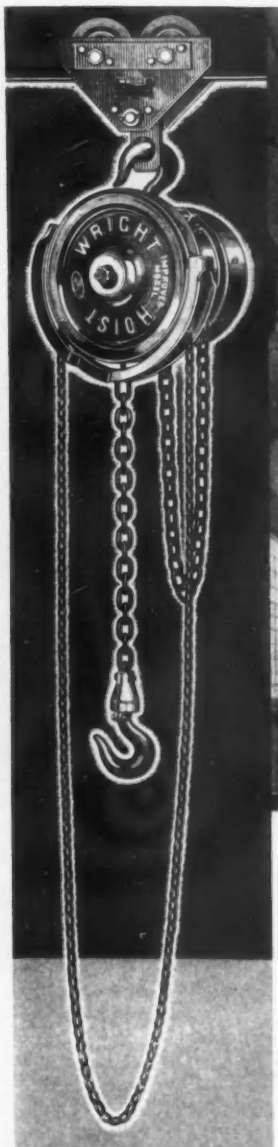

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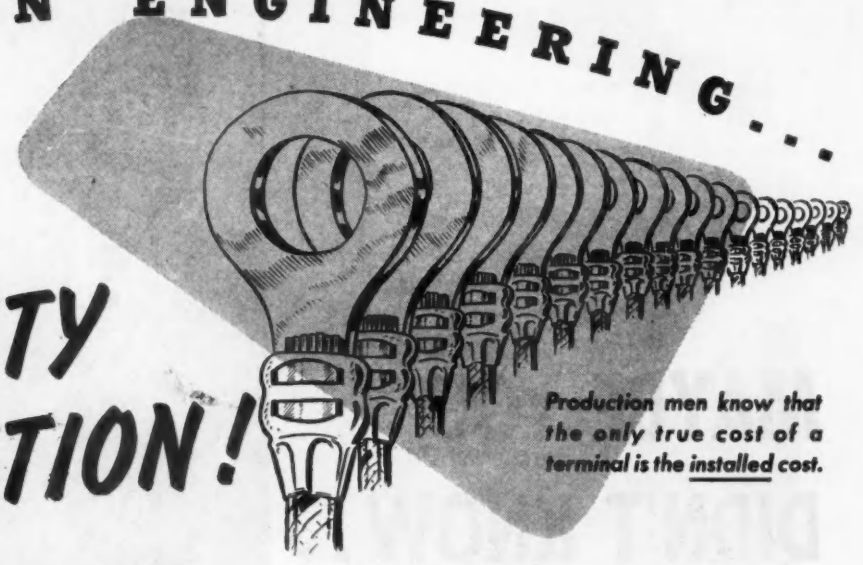

Production men know that the only true cost of a terminal is the installed cost.

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The AMP System of Solderless Wiring doubles production and cuts labor costs in half. This System is so simple and so accurate that every terminal connection is exactly like the one before, even when applied by inexperienced operators. Such outstanding assembly performance is the result of two highly coordinated factors: the Diamond Grip Insulation Support Terminal and the AMP Precision Die Hand and Power Installation Tools which make three perfect crimps on the terminal in one application; two on the wire and one on the insulation. (As against two separate crimping operations necessary on conventional insulation support terminals.) Each of these factors in its own right is an integral part of a complete production system.

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This pure copper terminal is approximately 32% lighter in weight and 3/32" shorter in length. It assures high mechanical and electrical efficiency and provides an insulation support which accommodates a wide range of wire and insulation sizes. But this is only half of the story. The self-gauging precision die installation tools developed by AMP engineers represent a new conception of the economics of applying millions of terminals to the ends of millions of wires — without variation.

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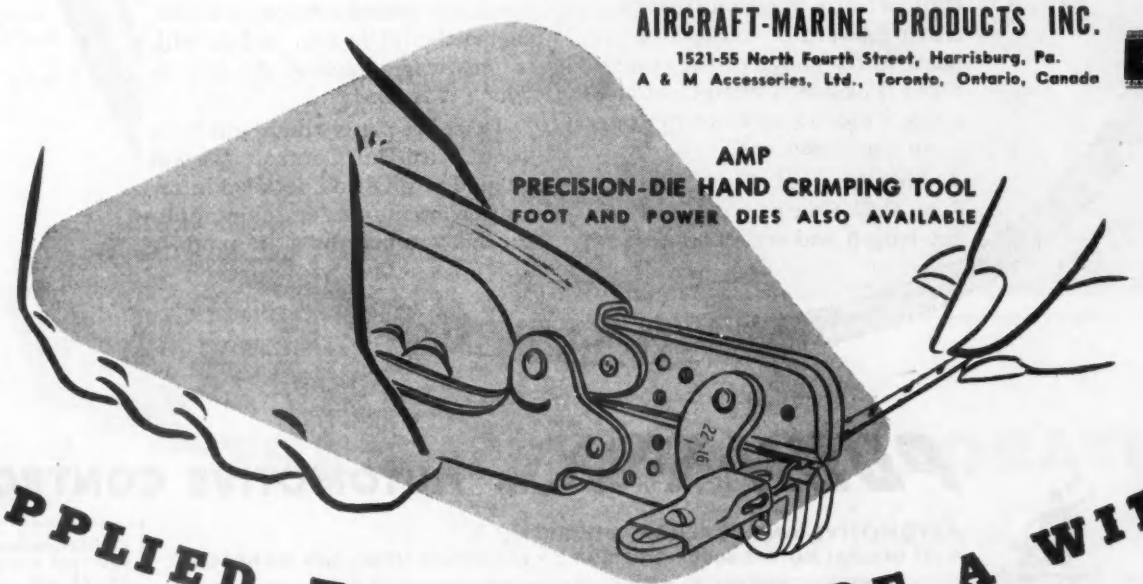


AMP
PRECISION-DIE HAND CRIMPING TOOL
FOOT AND POWER DIES ALSO AVAILABLE

"APPLIED TO THE END OF A WIRE"

MAYBE YOU DIDN'T KNOW..

...THESE FACTS ABOUT *PUSH*-PULL CONTROLS

Push-Pull Controls are well and favorably known, have been for years. However, new demands have resulted in new developments—refinements—improvements. So let us review what Push-Pull Controls have to contribute to your plans for peacetime production.

1. The operating member of a Push-Pull Control is an armored strand of preformed cable. These cables are made in 3 sizes: ⅛", 3/16" and ¼".

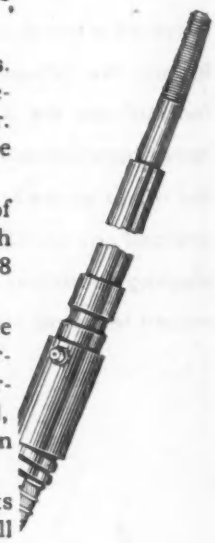
2. There are three types of Push-Pull Controls, governed by the fitting at the head or input end. The Regular allows for manual adjustment any place between the "ON" and "OFF" positions; Micro-Push-Pull permits micro-adjustment, either forward or back, from any point in the range of the control; Fixed Position Control provides quick, exact adjustment to two or more fixed positions.

3. Regular and Fixed Position Push-Pull Controls are made in any length and are standard with movement of 1, 2, 3 or 4 inches. Units with more than 4 inch movement are made on special order. Micro-Push-Pull Controls are made only with 3½ inch movement.

4. The fitting on the work end of the control has a swivel joint which permits side movement up to 8 degrees in any direction.

5. In all Push-Pull Controls, the armored strand operates in hermetically sealed lubricant, is permanently rattle-free and it will, in most cases, outlast the unit on which it is used.

These are merely highlight facts about Push-Pull Controls. We will be glad to give you detailed information about any specific applications you may have in mind.



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To MILLIONTHS of an Inch

UNUSUAL FEATURES FACILITATE FAST AND ACCURATE OPERATION

Model N-4 Internal-External Measuring Instrument is an entirely new Sheffield development for Toolroom and Gage Laboratory use in checking master and working gages, setting snap gages, etc.

- Checks internal dias. of ¼" to 12".
- Checks 3" max. depth of hole, 1 side.
- Checks external dimensions up to 12".
- Gaging arms elevated electrically.
- Indicator automatically shows height of gaging arms.
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- Positive electrical magnification of 2500 to 1 with Electrigage.
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MACHINE TOOLS • GAGES • MEASURING INSTRUMENTS • CONTRACT SERVICES

New landing light lenses molded of "LUCITE"

**Du Pont "Lucite"
reduces weight and breakage,
provides weather resistance and
dimensional stability.
Lens design boosts candlepower.**

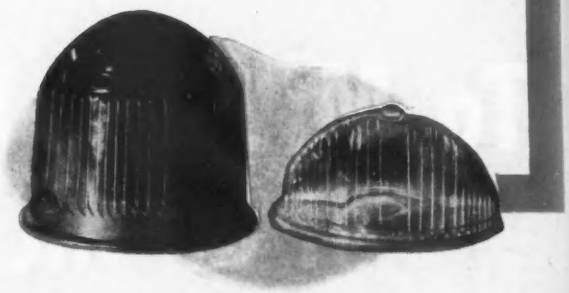
NEWS of another demonstration of the many advantages of Du Pont "Lucite" methyl methacrylate resin comes with the armed forces' release of the description of field lighting equipment in which this versatile plastic plays a major part.

The armed forces wanted this equipment to have light weight and resistance to breakage. It was necessary at the same time to improve the optical accuracy while maintaining good dimensional stability and weather resistance.

"Lucite" met all these requirements and made possible, in addition, a design which almost tripled candlepower from the same light sources.

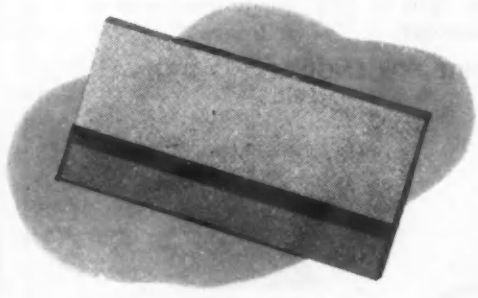
Do you have problems involving similar needs? "Lucite" may be the answer. Du Pont plastics technicians will lend you the help of their experience in solving plastics problems on war and development work. Address inquiries to: E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N.J., or 5801 So. Broadway, Los Angeles 3, California. In Canada: Canadian Industries, Ltd., Box 10, Montreal.

AVAILABLE: *Special story on Heat-Resistant "Lucite" molding powder. Write on your business letterhead for your copy.*



BEFORE AND AFTER the introduction of "Lucite" . . . a marker lens, part of the field lighting equipment. This is an ellipsoidal Fresnel lens, providing concentrated high candlepower beam at certain angles. Old lens weighed 39 ounces; new "Lucite" lens weighs about 3 ounces. High finish of mold surfaces makes the most of the high degree of light transmission of "Lucite." Because of high wattage and temperature of bulb, Heat-Resistant "Lucite" is used for these lenses . . . is injection-molded from top center sprue. Molder of all the lenses illustrated on this page is Stimson A'G'A Plastics.

ANOTHER IMPORTANT weight reduction is effected by use of Heat-Resistant "Lucite" for the obstacle lens. Old lens weighed 26 ounces; lens of "Lucite" only 3 ounces. Note three-color lens below.



INTERESTING DEMONSTRATION of the workability of "Lucite" is this tri-color lens, the application of which is still restricted. Three flat molded strips of general purpose "Lucite" —yellow, green, and red—are welded into a single homogeneous optical lens unit, an extremely accurate job in which skillful workmanship and good material combine to produce a superior product.

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DU PONT BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

GEARGRIND

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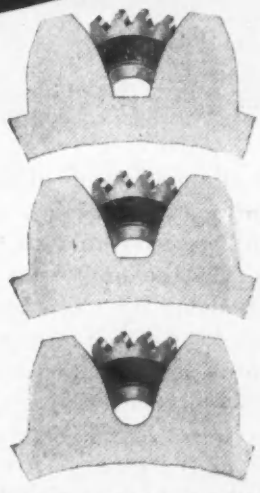

DEFINITE CONTROL OF ROOTS

GEARGRIND formed wheel trimmers and wheel trueing devices insure whatever root profiles your design calls for —straight roots or definite radius fillets as well as full radius roots giving absolute line continuity for carrying maximum loads.

The GEARGRIND method of Formed Wheel Grinding is demanded by many leading engineers because it insures volume production of finely finished, highly accurate parts that require a negligible amount of reworking.

Investigate GEARGRIND Machines at once, if your program calls for accuracy, fine finish and speed in the production of external and internal gears, external and internal involute splines, straight splines, serrations and racks.

Standard requirements are fully met by standard GEARGRIND Machines, but if you have a tough job requiring a special machine, we are in position to design and build it for you. Full information is given in our general catalog.

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- Far lighter, and much tougher than other nuts.
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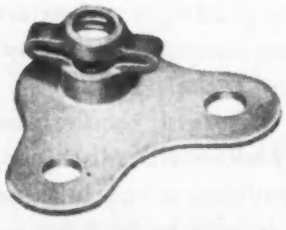

CORNER ANCHOR NUT —WING-STYLE

This is one type of the famous Boots All-Metal Self-Locking Nuts

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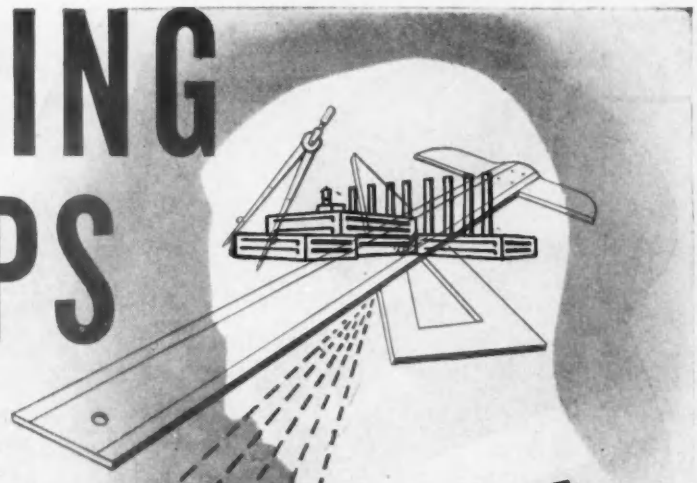

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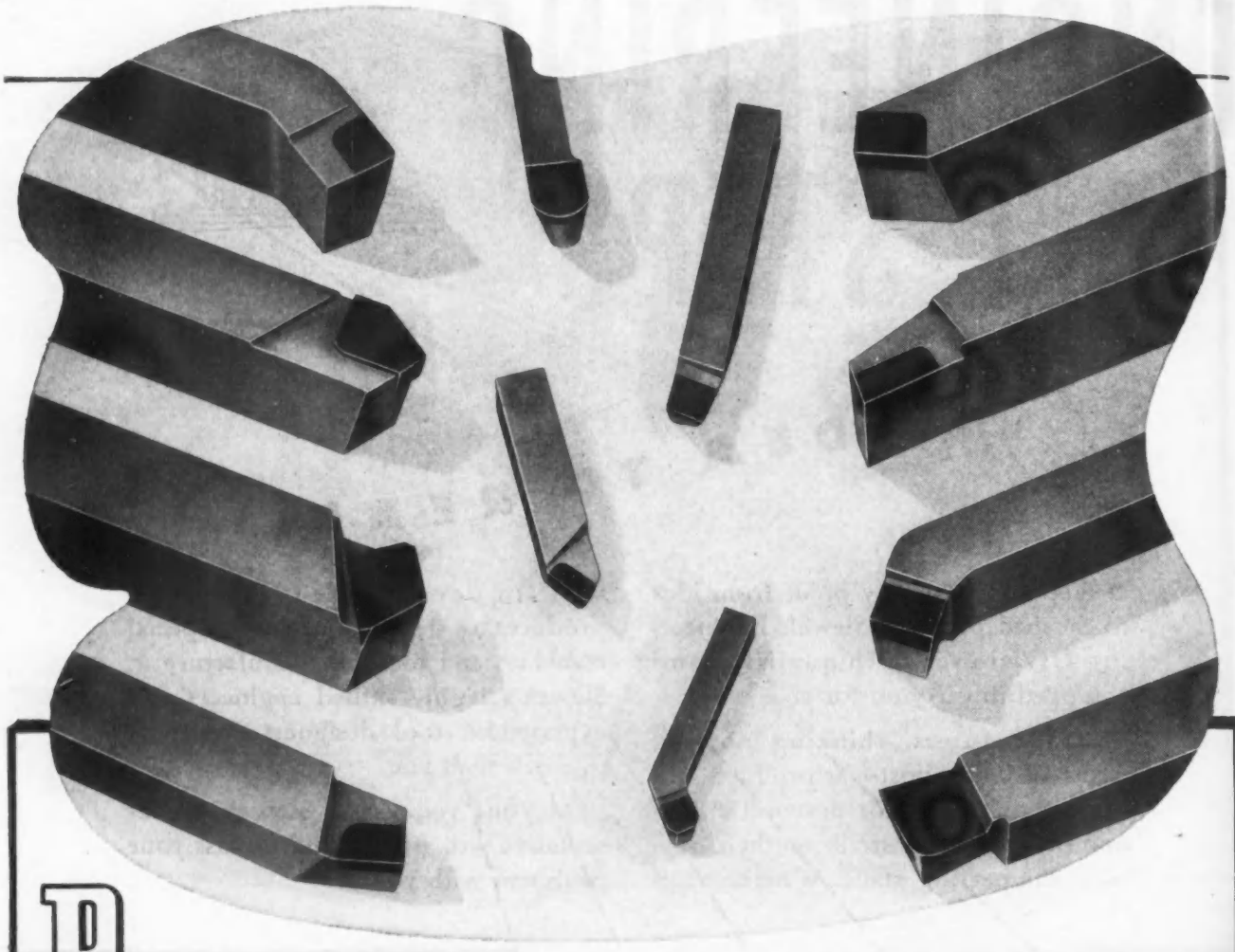

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More than 50,000 Allison liquid-cooled aircraft engines have gone to the United Nations fighting forces. ★ Into each of these engines have gone the precision and skill amassed by Allison and General Motors during the past quarter of a century. ★ Therein lies the secret of the power of Allison engines and their reliable performance in every major engagement of our Army Air Forces.

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Detroit: 809 New Center Bldg. Los Angeles: 324 N. San Pedro St. Chicago: 616 S. Michigan Ave.

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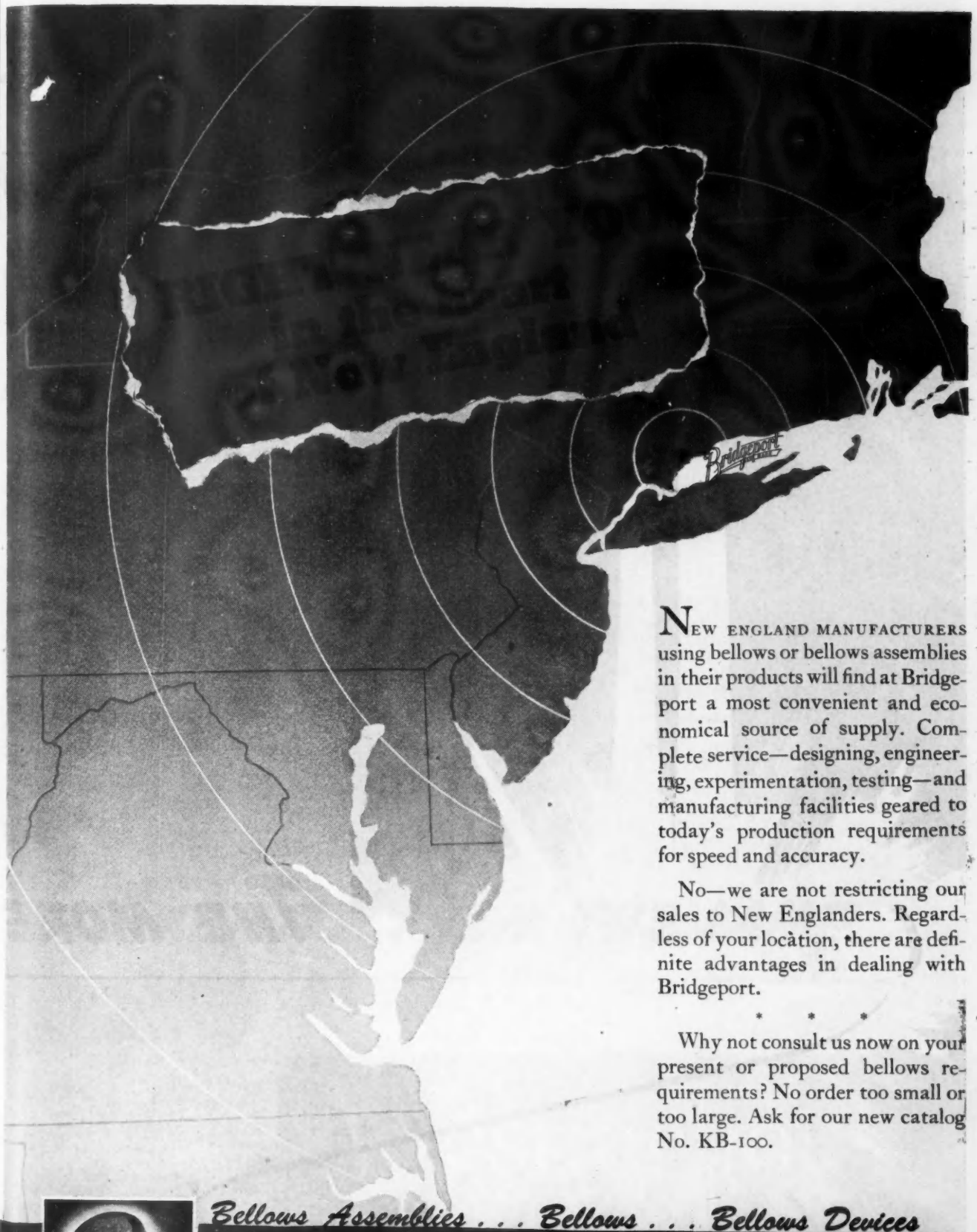

NEW ENGLAND MANUFACTURERS using bellows or bellows assemblies in their products will find at Bridgeport a most convenient and economical source of supply. Complete service—designing, engineering, experimentation, testing—and manufacturing facilities geared to today's production requirements for speed and accuracy.

No—we are not restricting our sales to New Englanders. Regardless of your location, there are definite advantages in dealing with Bridgeport.

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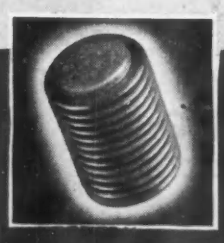
Why not consult us now on your present or proposed bellows requirements? No order too small or too large. Ask for our new catalog No. KB-100.



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FROM END TO END

SPARKLE IN THE POWDER . . .

The greater the care in selection and compounding of phosphor powders for fluorescent lamps, the greater the brightness from the lamp, and the more See-ability the lamp produces in service.

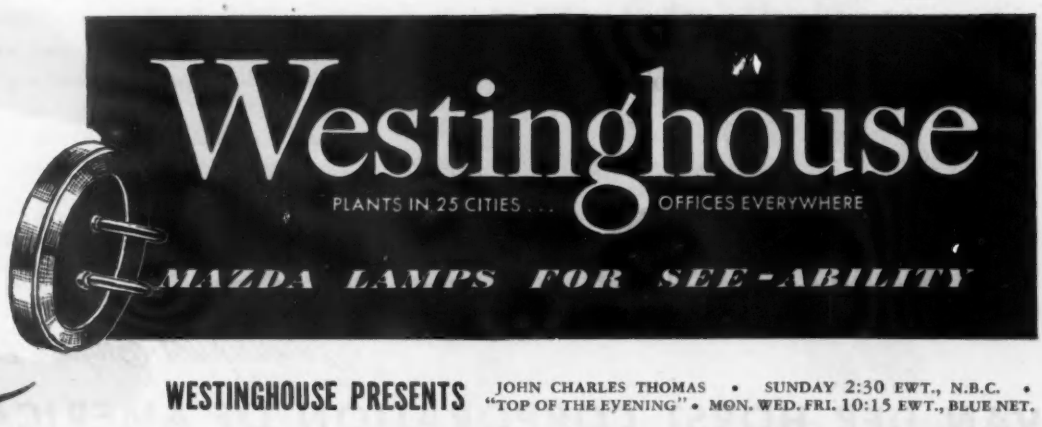
Westinghouse research engineers found, for example, that foreign substances in a batch —*just one part in a million*—make an appreciable difference in light output.

To eliminate these impurities, Westinghouse research has devised new and effective purification processes. A carefully planned and meticulously controlled routine of acid washing, high-temperature firing, grinding, mixing and blending, assures maximum purity and brightness performance in the finished phosphor.

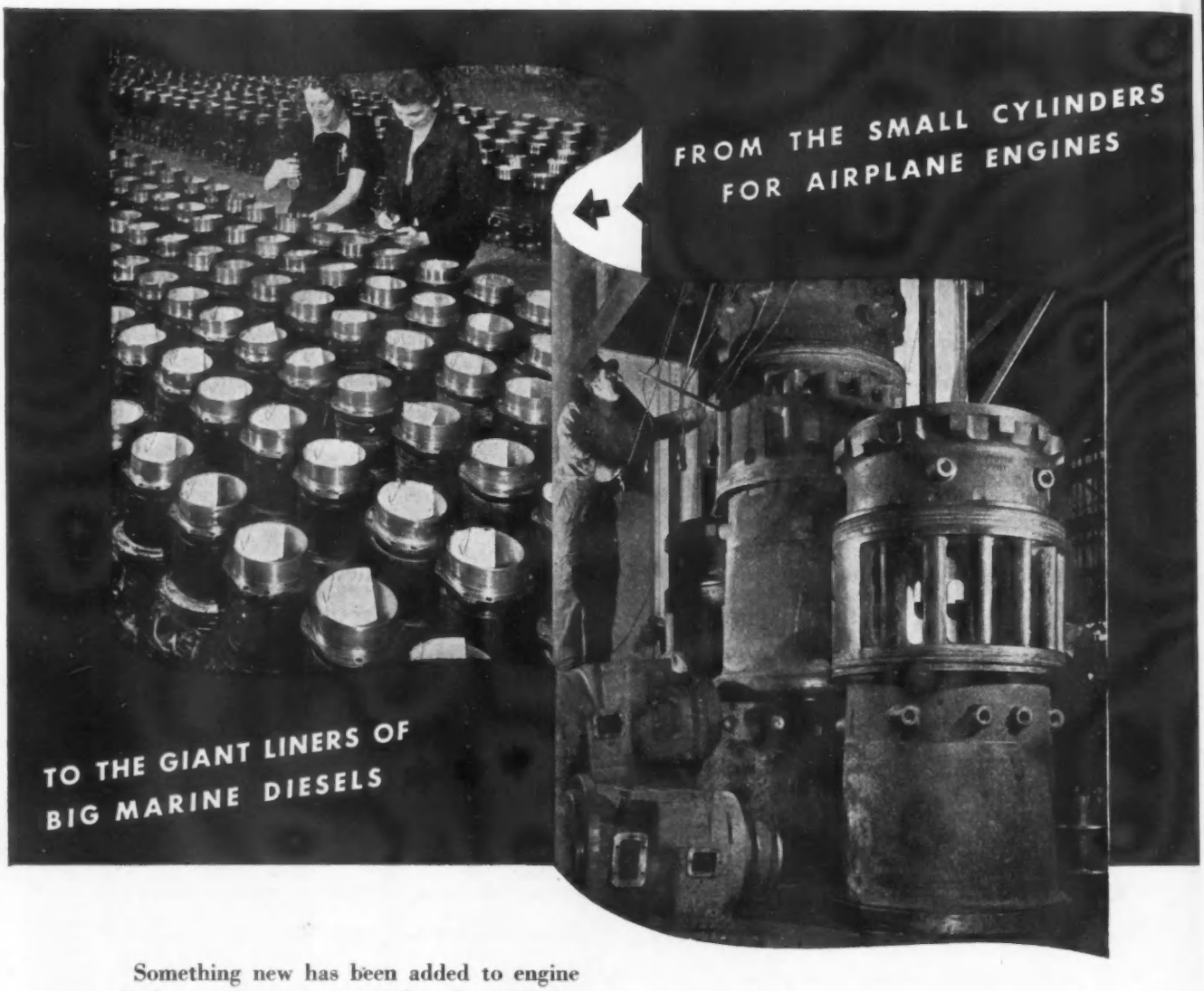
Next time you order fluorescent lamps, take advantage of this Westinghouse research and product improvement — ask your Westinghouse dealer for bright, long-lasting Westinghouse Mazda Fluorescent Lamps.

While much of our fluorescent production is earmarked for war industry, we are continuing as far as possible to supply fluorescent lamps for essential civilian use. Westinghouse Electric and Manufacturing Company, Bloomfield, New Jersey.

SEE-ABILITY FROM THE LAMP



WESTINGHOUSE PRESENTS JOHN CHARLES THOMAS • SUNDAY 2:30 EWT., N.B.C. • "TOP OF THE EVENING" • MON. WED. FRI. 10:15 EWT., BLUE NET.



Something new has been added to engine cylinders . . . a new process to lengthen cylinder life and give the engine greater reliability . . . more hours of continuous operation.

PORUS-KROME, applied to cylinder bores by the Van der Horst process, multiplies cylinder life 4 to 20 times, ring life 3 to 5 times, and reduces the risk of piston seizure.

PORUS-KROME isn't anything like the chromium most people know, decorative chromium, except that both are chromium. It is 250 to 750 times thicker than decorative chromium and isn't bright and beautiful because it is a bearing surface and contains thousands of tiny pores or pockets which retain lubricating oil.

The application of PORUS-KROME varies because every engine is different and has its own characteristics of operating conditions and wear experience. The Van der Horst process begins with a study of wear rates, service requirements, etc., which form the basis for the specification of the work to be done.

Our engineers are ready to make this preliminary study with your engineers at your convenience. In this way, you can have the facts before you when deciding on improvements to be made in your postwar engines.

VAN DER HORST TRADE MARK

PORUS - KROME

Multiplies Engine Life

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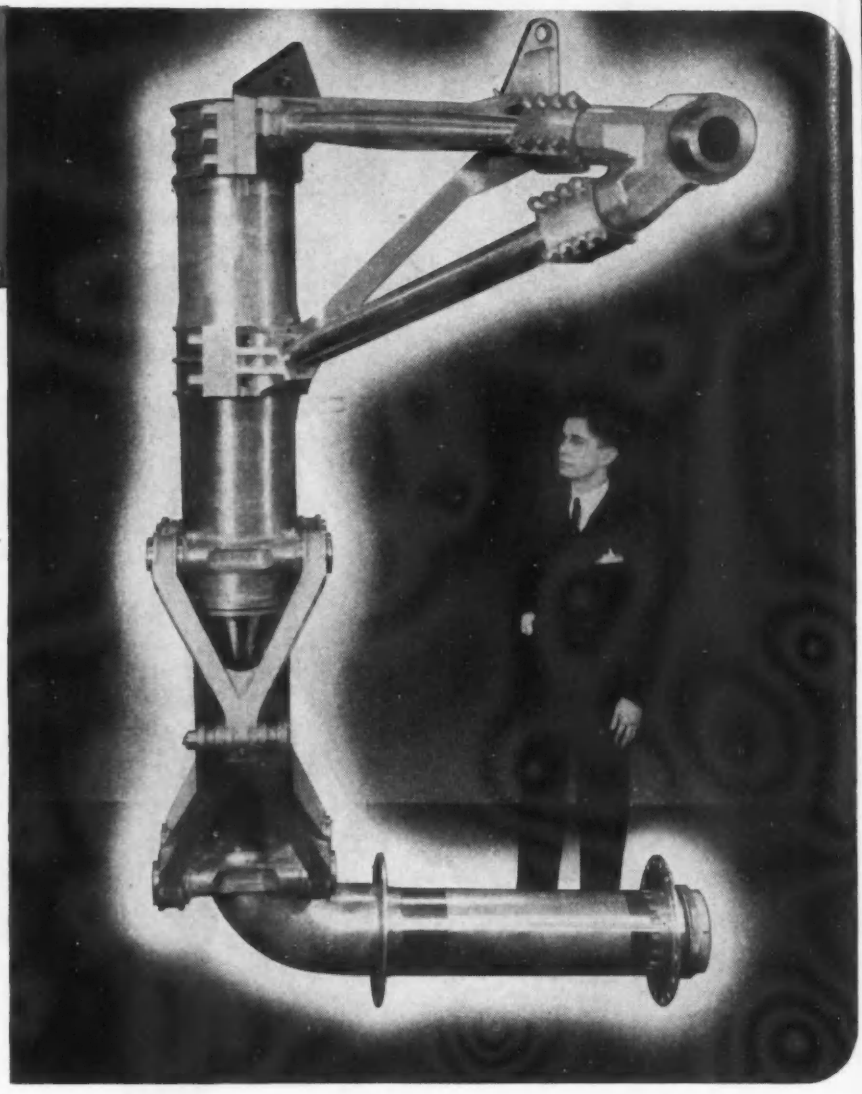

STEEL KNEES *for an* 80-TON WARBIRD

When an 80-ton battleship of the skies "sits down" hard on a concrete runway at 100 miles an hour, something must cushion the impact.

On the famous B-19 bomber, huge pneumatic-hydraulic aerols, like that above, help absorb landing shock—much as your knees helped soften the jolt of your boyhood back fence jumps.

The two mainlegs and nose strut weigh less than 4,000 pounds, but they were machined down from 53,000 pounds of rough forgings.

And there is an important reason for the use of Republic Electric Furnace Steel.

Costly man- and machine-hours were required to finish those close-fitting parts to exact tolerances. Had an imperfection in the steel caused rejection at final inspection, much labor and material would have been wasted.

But Republic Electric Furnace Steels provide extra insurance against such losses—because they are as CLEAN and SOUND as the most expert furnace practice and decades of experience can make them.

These fine steels are *consistently* UNIFORM—in physical, chemical, workability, hardenability values. They are homogeneous—free from variables that upset established practices. With them you can derive full benefits from mass production. And you can predetermine product qualities with exactness—because Republic Electric Furnace Steels are "targeted" by the precise control of electric furnace melting to hit the most rigid specification marks—accurately, repeatedly.

Republic's unequalled experience as the leader in this field of steel making and its increased capacity can help *YOU.* Ask us for further details.

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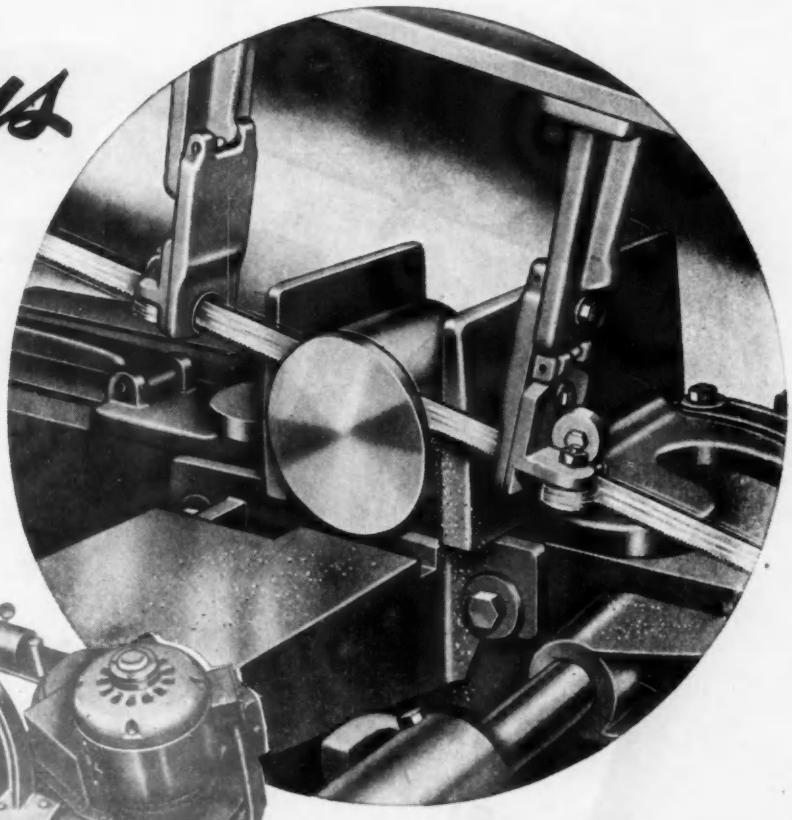
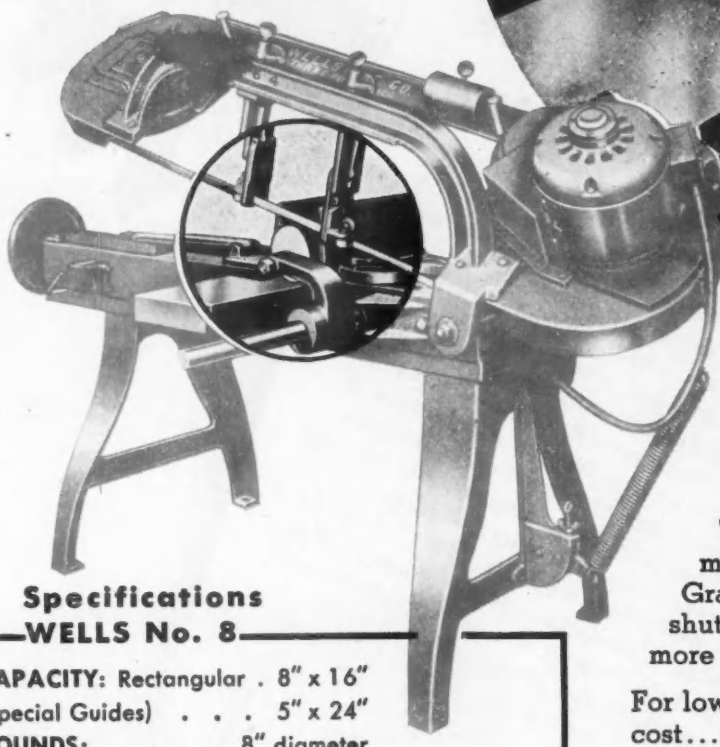
"QUALITY" steels . . . alloy . . . stainless

STEP UP PRODUCTION with

Continuous Cutting the WELLS WAY





An all-purpose metal-cutting saw, the Wells No. 8, can be used on production, in stores, toolrooms or on maintenance for dependable service in the cutting of metals.

Three-speed selection provides the most efficient cutting speed operation. Gravity controlled feed and automatic shut-off permit one person to keep 2 or more Wells Band Saws in operation.

For low first cost, installation cost and power cost... for a long service life with a minimum of maintenance use a Wells No. 8.

See your distributor or write direct for complete details.

Specifications
WELLS No. 8

CAPACITY: Rectangular	8" x 16"
(Special Guides)	5" x 24"
ROUNDS:	8" diameter
MOTOR:	1/2 H.P. current optional
SPEEDS:	Selective 60, 90, 130 ft. per min.
WEIGHT:	Approximately 750 pounds

Wells SAWS
THE SIGN OF SERVICE

Wells

Products by Wells are Practical

METAL CUTTING BAND SAWS

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FULLER
SHAPE
gives extra strength
plus longer wear-life
As the result of extended research and test, Fuller engineers have modified the time-honored formula for designing gear teeth, in order to produce a shape which reduced the stresses that lead to fatigue and breakage. Proof of the soundness of this engineering departure is found in the performance records of Fuller transmissions now in service, for the different tooth shape has long been employed on Fuller gears. Although the changes in dimensions are, of course, very small, their effect is surprisingly great in extending wear-life. This exclusive tooth shape is available only on genuine Fuller gears, and that is why, should replacement become necessary, you should make sure that the replacement gear bears the Fuller name.
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SPECIFICATION FOR TOMORROW'S PLANES:

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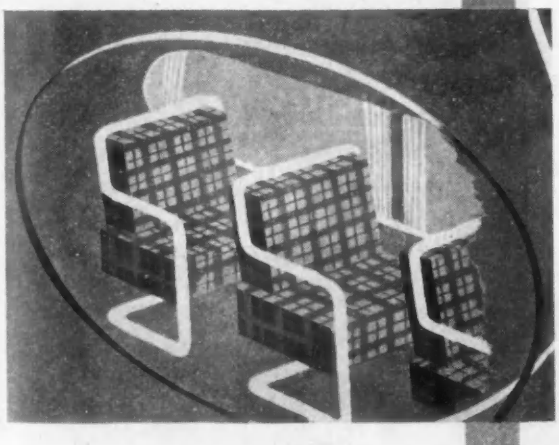

AND FOR TOMORROW'S CARS AND BUSES, TOO!

Velon, so colorful it creates wholly new possibilities for beauty and appeal in upholstery and trim — yet so durable that in thousands of test installations, it has withstood nearly 3 years of hard wartime use *with not one sign of wear!*

Velon, because it is stainless, highly resistant to acids, alkalis, greases and solvents — because it always looks fresh and colorful as new — because it can be wiped sparkling clean in a few seconds with a damp rag or with cleaning fluid!

Velon, because it is light in weight, yet non-inflammable!

Nowadays, all our production of this wonderful new material is going to the government. But after the war . . .

For whatever transportation vehicles you make — take advantage of the added sales appeal that "Interior of *Velon*" will mean!

P.S. For *completely* modern seats, make the cushioning FOAMEX.

ANOTHER CONTRIBUTION TO A BETTER WAY OF LIFE *by* **Firestone**

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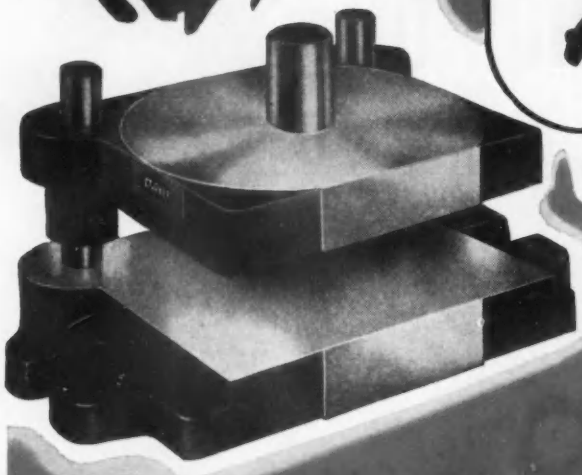

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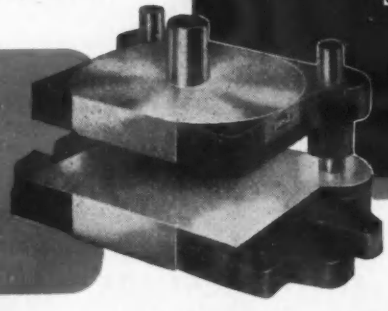
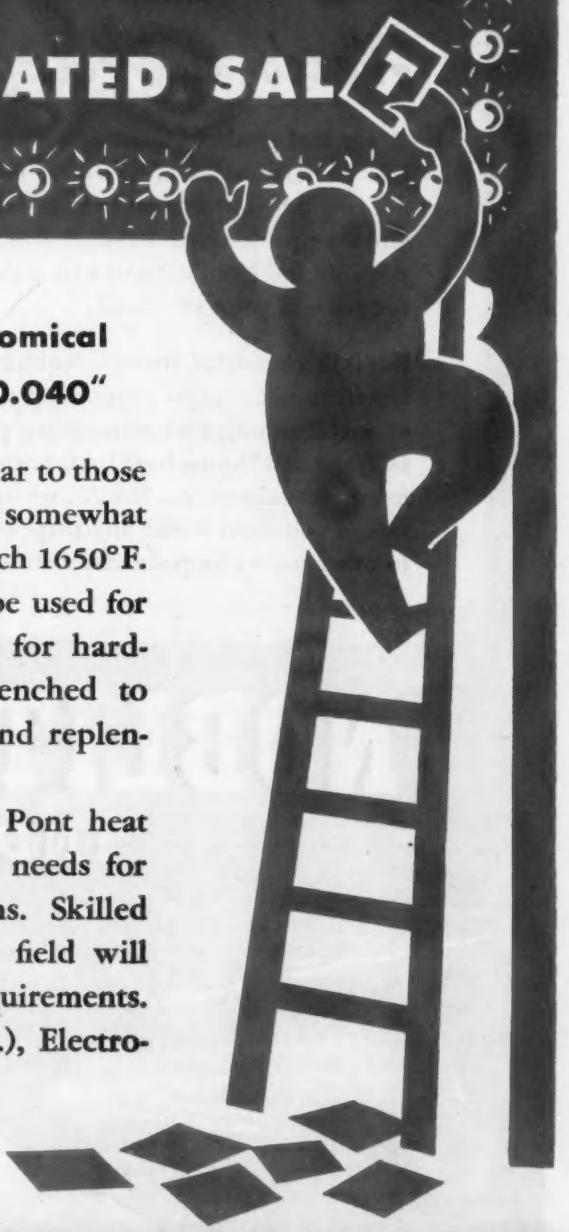


DIE MAKERS SUPPLIES • *Welded Steel Fabrication*

SPEED...ECONOMY...CONTROL WITH DU PONT ACCELERATED SALT



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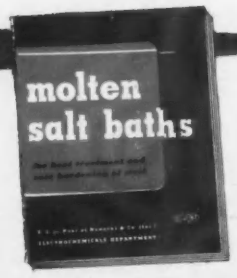

FREE MANUAL ON MOLTEN SALT BATHS

More than 70 pages of practical material on heat treatment, fully illustrated. Ask for your copy.

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IF YOU NEED . . .

Fabricated Metal Tubing

. . . OR TUBING AND STAMPING ASSEMBLIES

Here's a Helpful, Dependable Source

● **For that product** you're planning to put into production soon, or later, you may be needing fabricated metal tubing—or tubing and stamping assemblies. And it may be possible for Noblitt-Sparks to make them for you—to your advantage.

Why is that possible? Because Noblitt-Sparks has tremendous capacity for the production of metal tubing and stampings—plus the facilities and "know how" to fabricate them to your requirements. Yes . . . we make the tubing and form it into any shape—weld it to other parts stamped from metal—assemble, plate or paint the entire unit—ready to go into your product.

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Harlow Faulke

Vice-President and Director of Manufacturer's Parts Division
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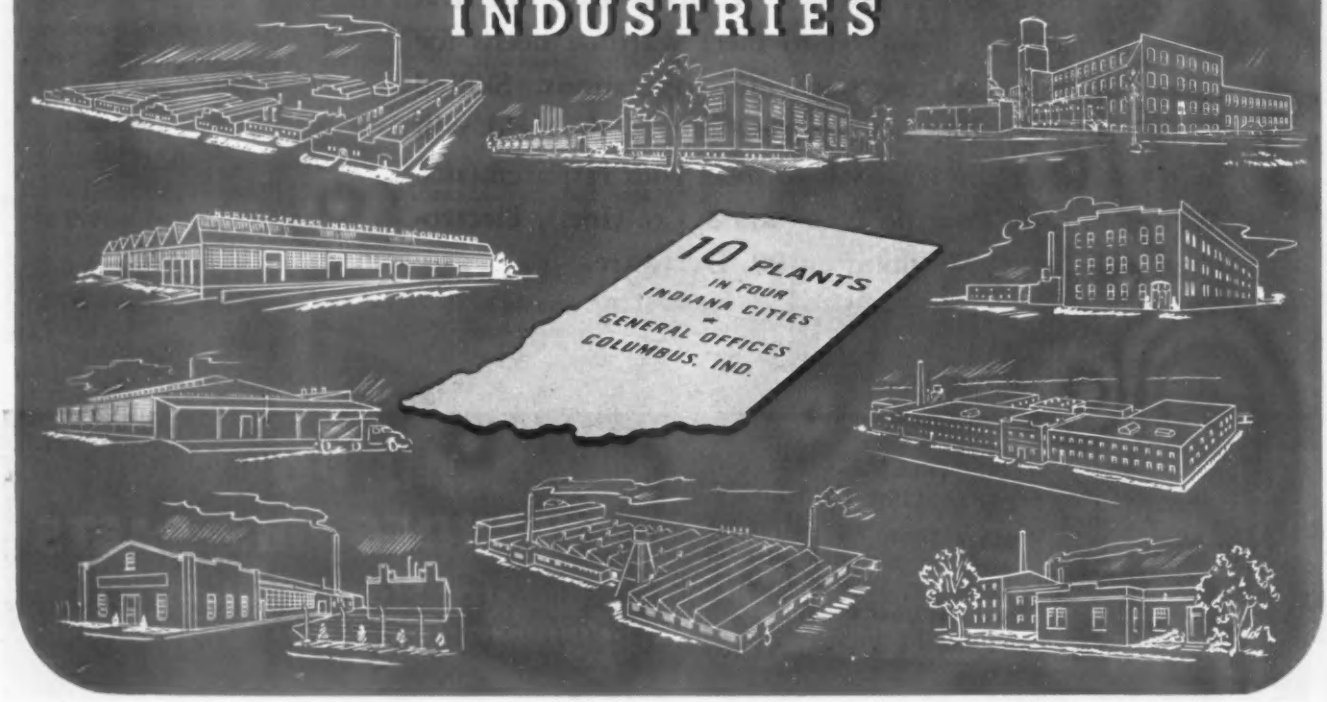
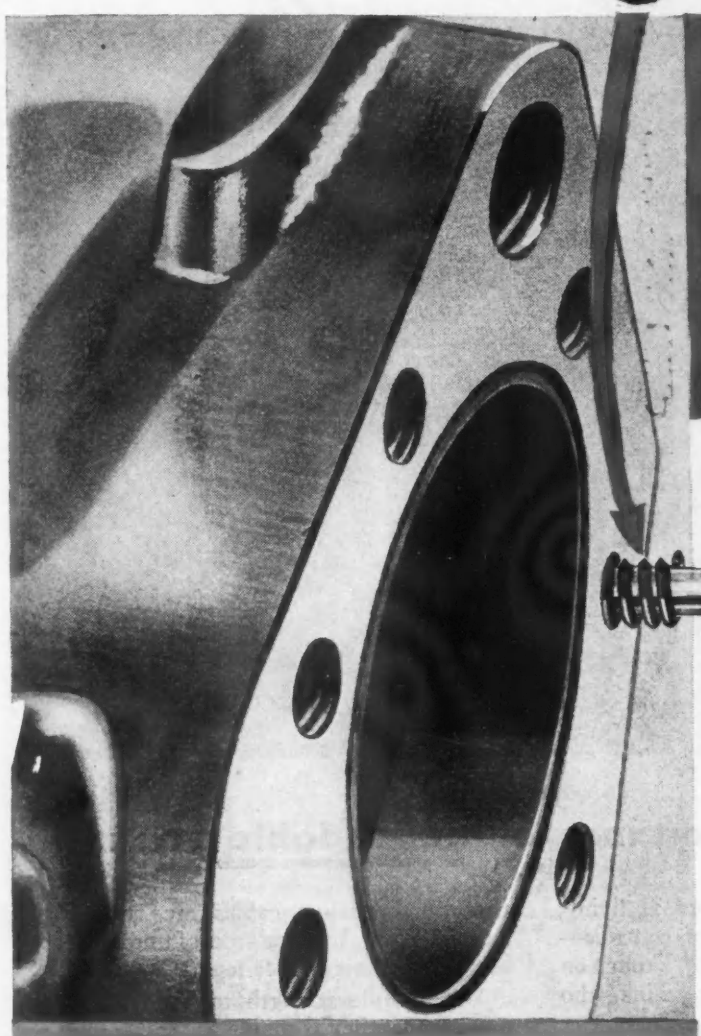
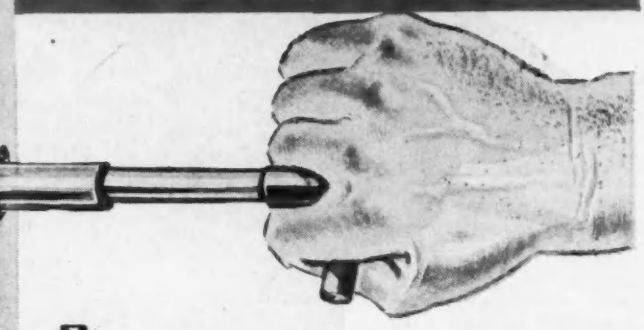


HOW THIS LITTLE "Heli-Coil" INSERT



Saves AN EXPENSIVE PART FROM THE SCRAP PILE!



SALVAGE departments save expensive parts accidentally tapped too large, by using "Heli-Coil" Inserts. This eliminates the need for oversize screws or studs. "Heli-Coil" Inserts are precision-shaped helical coils of stainless steel or phosphor bronze wire, which engage screw threads of the American National System.

The MAINTENANCE branches of the armed services, as well as of air transport organizations, use "Heli-Coil" Inserts for repairing parts having broken or loose studs. FIELD SERVICING units of the Army and Navy are supplied with kits of "Heli-Coil" Inserts and Tools for quick repairs to engines and accessory parts involving broken or loose studs in the field.

Servicing is done in three simple steps: 1. REAM out the worn threads; 2. RETAP the hole with "Heli-Coil" Tap; 3. INSTALL "Heli-Coil" Insert. It's as easily done in the *field* as in the *factory!*

FOR ORIGINAL INSTALLATIONS

"Heli-Coil" Inserts are widely used in original installations—to provide a hard, anti-friction, protective lining for tapped threads in aluminum and other light metals. They can be used in bosses designed to accommodate studs without provision or room for a screw bushing. Send for engineering folders today.

Heli-Coil INSERTS
ARE USED IN
ARMY, NAVY AND TRANSPORT AIRCRAFT
ENGINES, ACCESSORIES AND PARTS FOR
SALVAGE • MAINTENANCE • FIELD SERVICING
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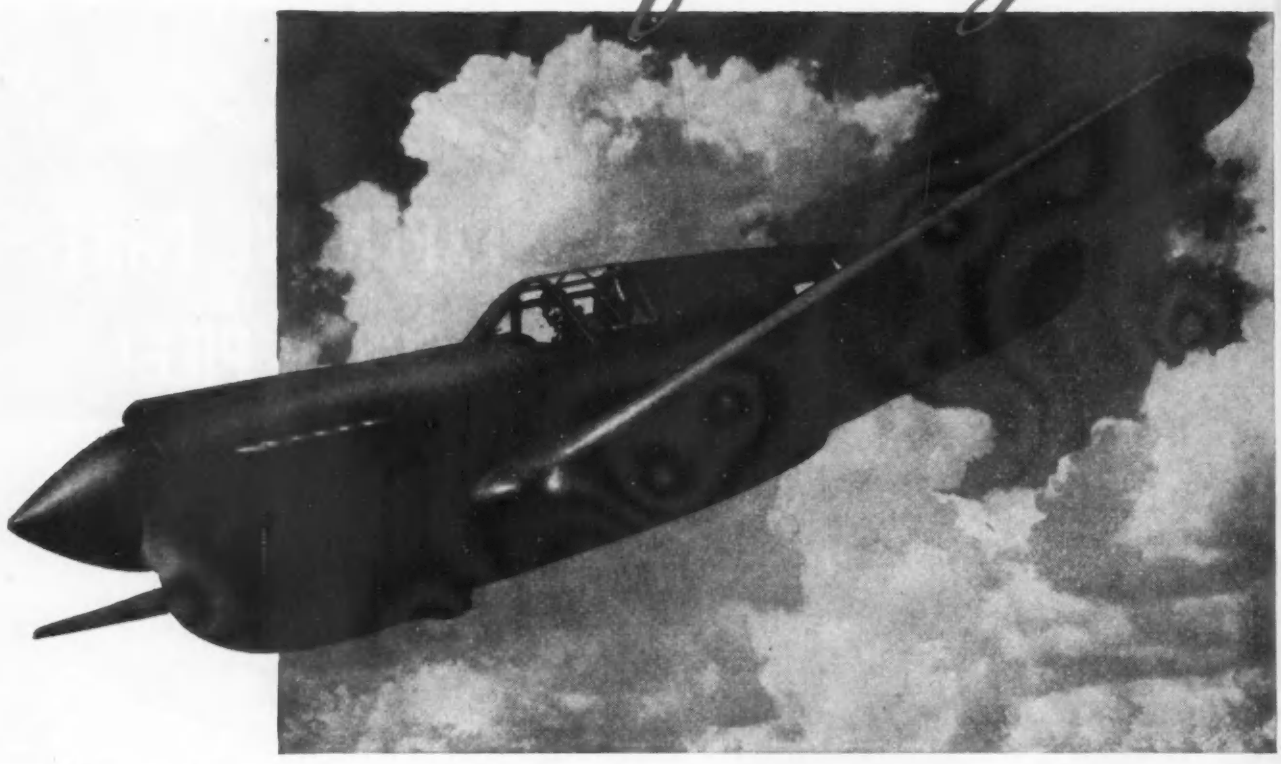
THE PLANE WITH THE *habit of coming back*



proves the importance of dependable controls

In the grim business of combat flying, quickness and sureness of controls—hair-trigger response to the pilot's touch on switch and lever—often determine who will return from a mission.

The Curtiss P-40 Warhawk, famous veteran of this war's battle skies, uses American Tiger Brand Control Cables to provide the sensitive, unfailing response so necessary for survival.

Because of the flying safety they assure, these high-quality cables are standard equipment on America's most famous combat and commercial planes.

With ample strength to handle maximum loads, they combine lightness, minimum stretch, excellent flexibility and superior resistance to fatigue, wear and abrasion.

The fact that they are of Excellay Preformed construction is further assurance of their flawless performance in service.

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UNITED STATES STEEL

1 Drill 5/16" hole 3-1/16" deep

2 Drill 27/64" hole 2-9/16" deep

3 Drill Through 2 walls with 21/64" drill

Miscellaneous Holes Drilled 8 Times Faster with W. F. & JOHN BARNES UNIT TYPE MACHINES

Drilling Time Reduced from 10.65 to 1.30 Minutes per Crankcase

Doing the same job in one-eighth the former time . . . that's the production rate set by a W. F. and John Barnes unit type 3-spindle three unit machine in the plant of this large aircraft engine manufacturer. Actual time saved per crankcase in performing this 3 hole drilling operation was 9.35 minutes. Two machines were formerly required to do the job. By being able to perform the same operations on a single unit type machine, valuable man hours are saved and floor space conserved.

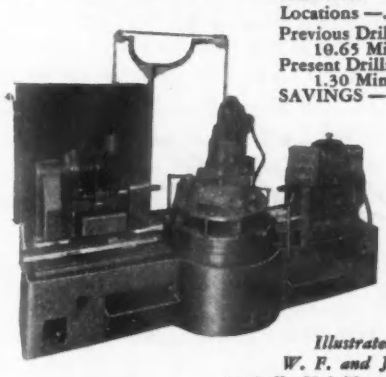
TOOLING AND OPERATIONS

Unit 1 — 5/16" drill.
Unit 2 — 27/64" drill.
Unit 3 — 21/64" drill.

Units 1 and 2 — Provided with step-drilling attachment.

Units 1 and 2 provided with coolant manifolds (not shown) when rifle drilling these holes.

Diameters — .003" — .004".
Locations —. 010".
Previous Drilling Time — 10.65 Min.
Present Drilling Time — 1.30 Min.
SAVINGS — 9.35 Min.



Illustrated at the left is a W. F. and John Barnes 3-way 3-spindle Unit-Type Machine for machining airplane engine intermediate rear crankcase. Tooling for this job is illustrated above.

Unit Machines are Designed to Perform a Number of Operations

Performance stories of this kind are being continually submitted by users of W. F. and John Barnes unit type machines. Their versatility makes them highly adaptable to many types of machining operations. They are constructed from standard hydraulic feed and drive units which are easily rearranged to accommodate changes in part design. Where operations are required on a number of different parts quick-change heads can be provided. The general design of unit machines readily lends itself to a rapid conversion from war to peace-time production.

Submit Your Production Problems to our Engineers

The next time you are confronted with a production problem submit it to our engineers. They will make a complete analysis of it and suggest a machine to solve it. Their advice, based on years of experience in the design and construction of special machine tools, will result in greater production economy. This service is offered to you without cost or obligation.

FREE Useful Machining Information will be sent upon request.

5 booklets on W. F. and John Barnes machines and their applications. Write for Bulletins Number 544A.

8 booklets showing typical tooling applications and problem solutions. Write for Bulletins Number 544B.

W. F. & JOHN BARNES

W. F. and JOHN BARNES

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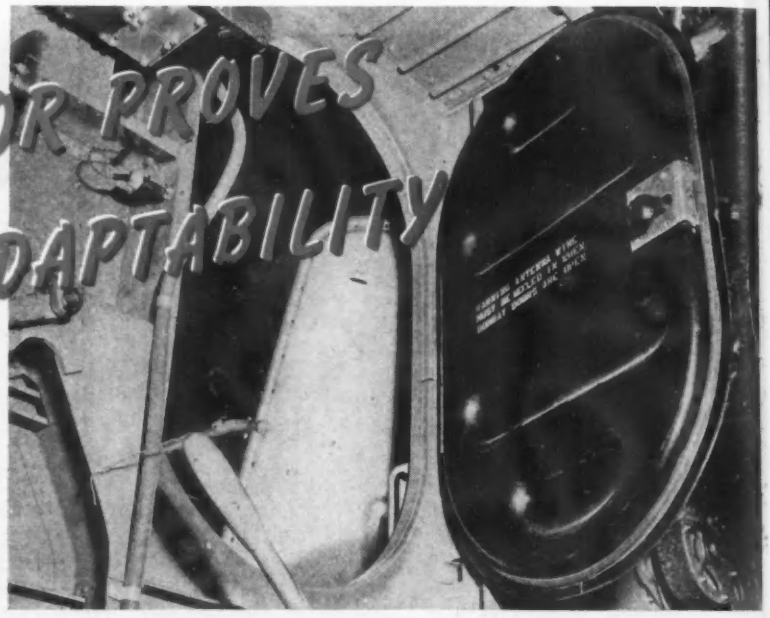
FUSELAGE DOOR PROVES PANELYTE'S* ADAPTABILITY

FOR LARGE STRUCTURAL PARTS



A—PANELYTE Fuselage Door, open. Note absence of rivets to hold the parts together, intricate molding, and rubber gasket.

PRONOUNCED "revolutionary in its many advantages," the new type PANELYTE Fuselage Door was developed by Panelyte engineers in cooperation with the Glenn L. Martin engineering staff. Its installation in the Martin B-26 "Marauder" indicates the increased use of PANELYTE for larger aircraft parts. If you are using large structural parts whose production should be speeded by straight-line mass production, it will be worth your while to consider the following factors.

WEIGHT SAVING – Inasmuch as the specific gravity of PANELYTE is only one-half that of aluminum, the use of the PANELYTE Fuselage Door effects a worthwhile saving even though the two sections of the PANELYTE unit are slightly thicker than the aluminum. (Added thickness, providing greater rigidity, is a decided asset.)

SUPERIOR RESISTANCE TO VIBRATION – The PANELYTE Door withstands vibration and subsequent oil-canning because PANELYTE'S vibration resistance is far higher than that of aluminum. The damping characteristics of PANELYTE enable this unit to withstand the high and low pressures existing during a bomb run.

PROMPT DELIVERY—AT LOWER COST – Both sections of the PANELYTE Door are molded *in one press in a single operation*, then rapidly vulcanized together, and gasket permanently bonded to flange. Riveting of locks, etc. completes the job—with "on time" shipment assured. The economy of PANELYTE is another point in its favor.

By test and use PANELYTE has long proved its value – in the new and constructive use of flat sheets for airplane skin...molded aircraft flooring and heavy duty cargo flooring – in the production of molded laminated instrument panels, navigators' table drawers, stowage boxes and aircraft pulleys – and in such dramatic developments as push rod housings and the manufacture of hundreds of thousands of engine baffles. PANELYTE Engineers are available for immediate consultation on any problem involving the use of thermo-setting structural plastics for large – or small – parts.

PANELYTE *the structural plastic*

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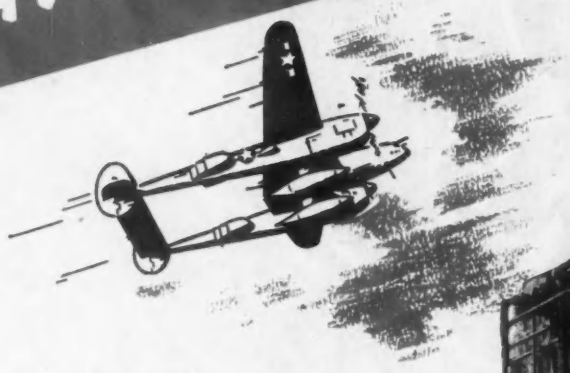
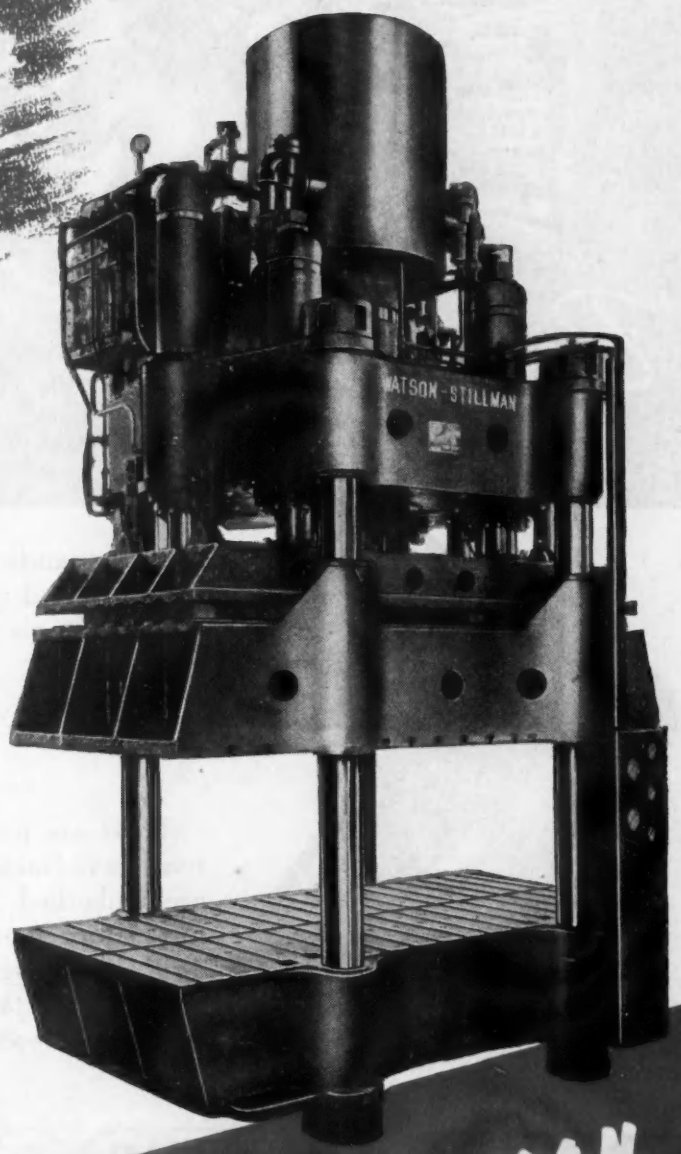
Deep-Drawing Operation On W-S Double-Action Press SAVES CRITICAL HOURS





THIS giant 800-Ton Watson-Stillman Hydraulic Forming Press is helping to speed delivery of aircraft to war fronts overseas. Equipped with deep-drawing dies, it turns out droppable fuel tanks which make possible the flying of Lockheed P-38 Lightning fighter planes direct from factory to European destinations. By means of double-action dies designed especially for this production operation, performing, drawing, and trimming of blanks are accomplished simultaneously. In this way, important savings in production time are effected.

The same features that enable this press to help speed output of aircraft parts are available in all Watson-Stillman presses for extrusion, bending, straightening, assembling, forcing, molding, and other metal-working operations. Whenever hydraulic equipment is needed for any purpose, be sure to consult Watson-Stillman engineers for recommendations backed by nearly a century of experience. Write for Bulletin 110-A to Watson-Stillman Company, Roselle, New Jersey.

This W-S Double-Acting Hydraulic Forming Press has a capacity of 800 tons; platens measure 12 ft. x 6 ft., opening, 4 ft., 4 in.; stroke 3 ft., 7 in.; height, 22 ft., 6 in. A self-contained unit with single operating lever control.

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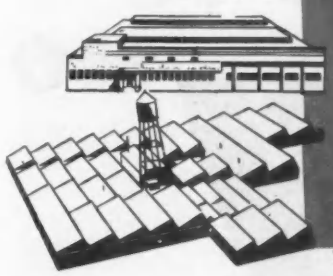

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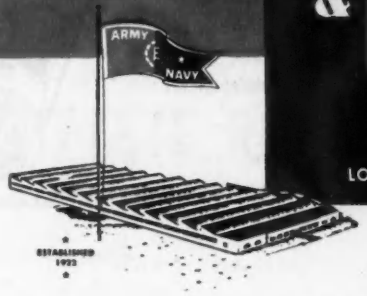

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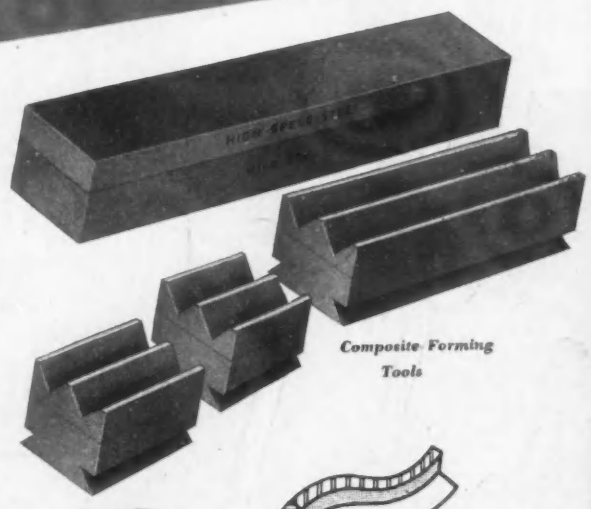
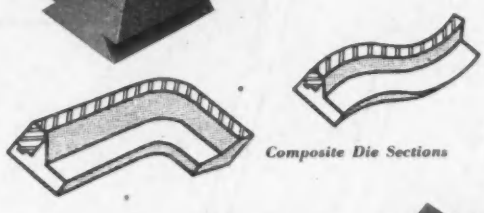
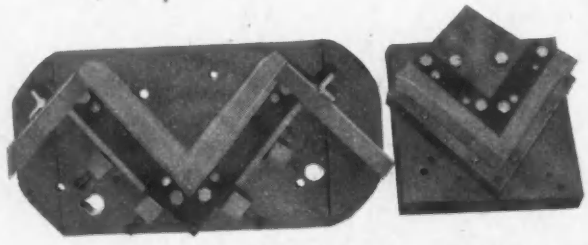
and
COMPOSITE DIE SECTIONS



Composite Forming Tools



Composite Die Sections



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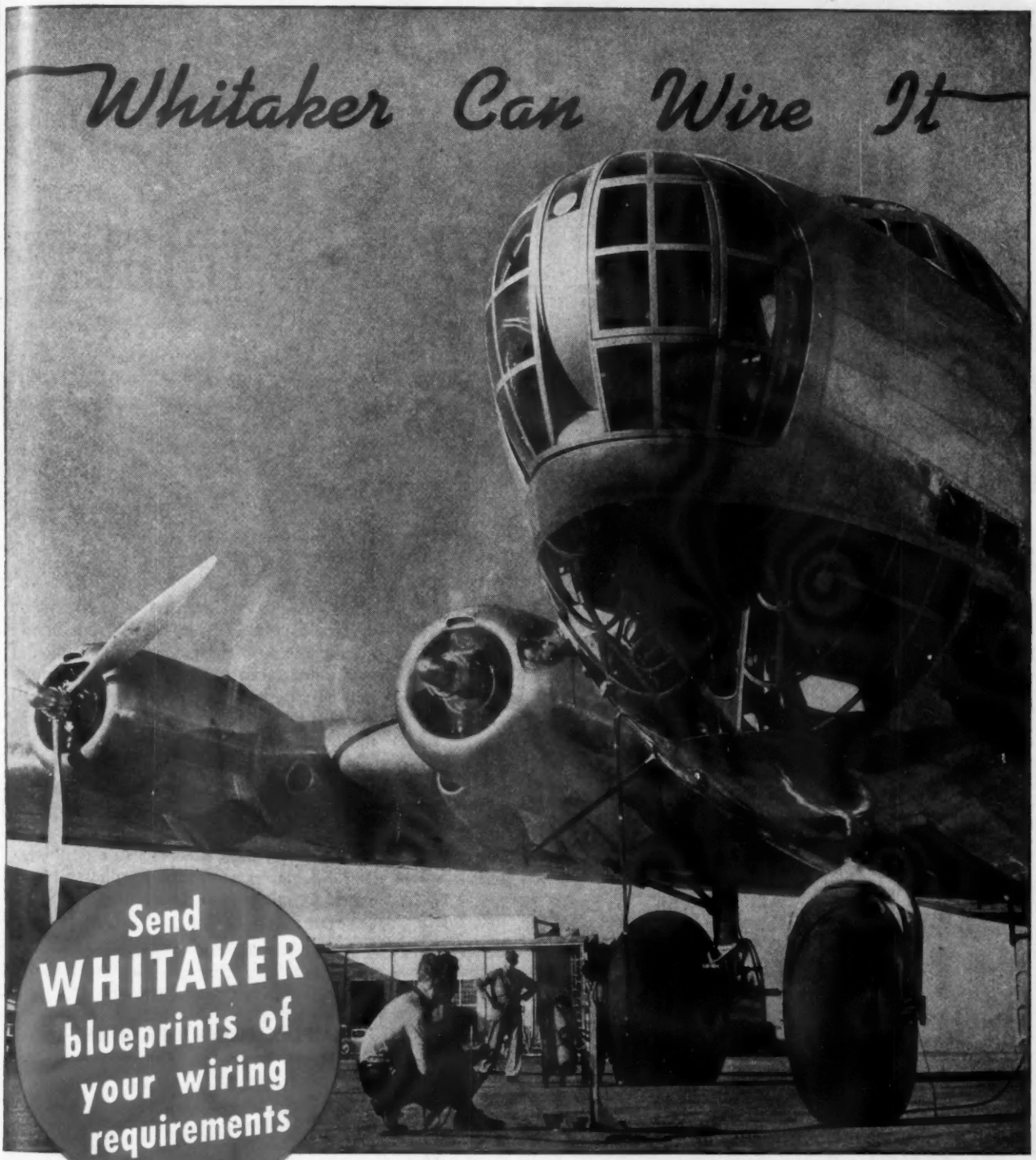

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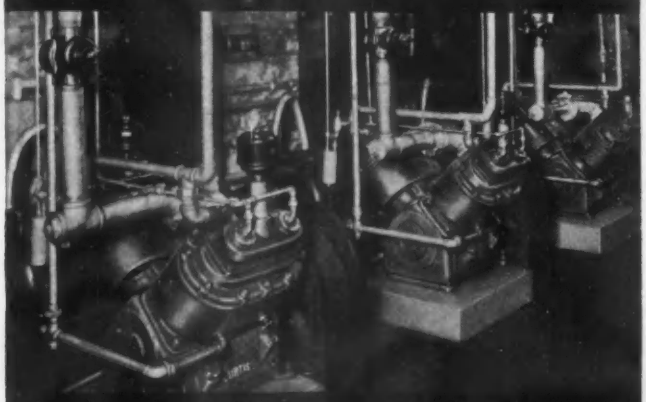

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J. H. Klasey, plant engineer, states that "they gave surprisingly good service with very little maintenance."

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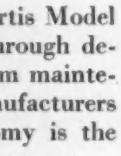
- Precision Construction Throughout

Curtis Compressors are available in capacities up to 300 cfm. For proof of their efficiency and operating advantages, send the coupon for full information and free booklet, "How Air Is Being Used in Your Industry."



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Today, however, we wish to pay tribute to those red-blooded, tough-gutted men up front who are doing the war-winning job **for** us; the boys in the Pacific island mudholes . . . in the jungles of Burma . . . in the hot sands of Africa and the soggy dug-outs of Italy; the boys who man the ships, the subs, the planes, the tanks and the guns.

But for these boys, our great fleets of giant bombers and fighters . . . our acres of tanks and trucks . . . our oceans of battleships, plane carriers and subs . . . our stacks of high powered rifles, tommy and machine guns . . . the products of our great industrial world, would be utterly useless.

Hats off and coats off to you fellows of the front . . . God speed your early victory!

SIMPLEX PRODUCTS CORP.

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REYNOLDS is far more than a great *new* source of aluminum . . . it is a *complete* aluminum service. From the mines to the finished part, Reynolds' facilities speed production and lower costs.

When design changes threaten to play havoc with your plane production curve, Reynolds can help you by putting additional resources, manpower and engineering skill at your disposal. When you are trying to assemble previous designs and get new models into production simultaneously, Reynolds pre-fabricated plane parts will smooth your operations and enable you to switch to improved models without lost time.

Reynolds offers two types of plane parts service—completely pre-fabricated and semi-finished. Pre-fabricated parts are ready for the assembly line when received by the plane builder . . . carefully cut and formed to the closest tolerances. Semi-finished parts are routed to the required contour in the Reynolds plants . . . ready for further forming or other finishing operations.

Accurately controlled speed is the order of the day . . . and pre-fabricated plane parts are helping speed plane production by eliminating thousands of otherwise wasted man-hours. When pre-fabricated parts are used, only the aluminum actually built into the plane is shipped . . . the 30% scrap loss is held at the Reynolds plant, to be converted back into new metal in a matter of days instead of months.

Your inquiries on any phase of this *complete* Reynolds service are invited. Reynolds Metals Company, Aluminum and Parts Div., Louisville, Ky.

One of the many powerful hydraulic presses at the Reynolds parts plants. Equipment is available to preform practically any type or size of aluminum part. (*top left*)

Finishing plane parts at the Reynolds plant. All parts are worked to required tolerances and Army-Navy inspected prior to shipment. (*top right*)

Reynolds pre-fabricated plane parts save thousands of man-hours. Furnished two ways—carefully finished to closest tolerances, ready for assembly, or accurately blanked, routed and drilled—ready for finishing. (*lower right*)

REYNOLDS METAL

REYNOLDS ALUMINUM

Helping Uncle Sam Sink Enemy Subs

Kempsmith Millers in Service on U. S. "FLAT TOPS" . . .

For 56 years, Kempsmith has been a world-wide by-word for America's supremacy in milling machines and a creditable factor in advancing the American way of life. Today, with our country at War, Kempsmith is doing its duty, both on the production front and on the fighting front. Rugged Kempsmith milling machines are being used in the manufacture of essential war equipment. And on the far-off fighting fronts, sturdy Kempsmith machines are maintaining and repairing this equipment. The Kempsmith Miller serving on the Carrier "U. S. S. Card" is a typical example. Kempsmith is proud of the citation shown below, and anxious to continue in the service of our nation.

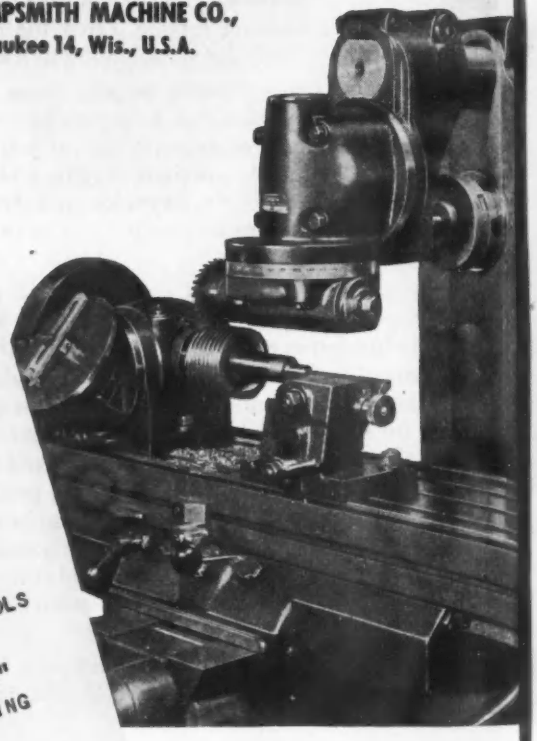
The KEMPSMITH MACHINE CO.,
Milwaukee 14, Wis., U.S.A.

BY DIRECT WIRE FROM
WESTERN UNION

LONG WU W49 NL=
CT WASHINGTON DC DEC 18=
TO THE MEN AND WOMEN OF KEMPSMITH MACHINE CO=

THE EXCELLENT PERFORMANCE OF A KEMPSMITH MILLING MACHINE IS CITED IN A REPORT FROM THE "USS CARD". THE "BABY FLAT-TOP" WHICH TOGETHER WITH HER ESCORT SHIPS WAS RECENTLY AWARDED A PRESIDENTIAL UNIT CITATION FOR SINKING MORE ENEMY SUBMARINES THAN ANY SIMILAR GROUP IN NAVAL HISTORY. THE REPORT STATES: "THE MACHIVE SHOP IS ONE OF THE BUSIEST SPOTS ON THE CARRIER. TOOLS ARE IN CONSTANT USE REPAIRING BOTH SHIP AND PLANE EQUIPMENT. THATS WHY WE ARE GLAD TO HAVE THE BEST." YOU ARE TO BE CONGRATULATED FOR PROVIDING OUR FIGHTING MEN WITH SUCH RELIABLE MACHINE TOOLS.=

W B YOUNG REAR ADMIRAL (SC) USN
CHIEF OF THE BUREAU OF SUPPLIES & ACCOUNT
USS CARD USN. DEC 20 1943 846A.

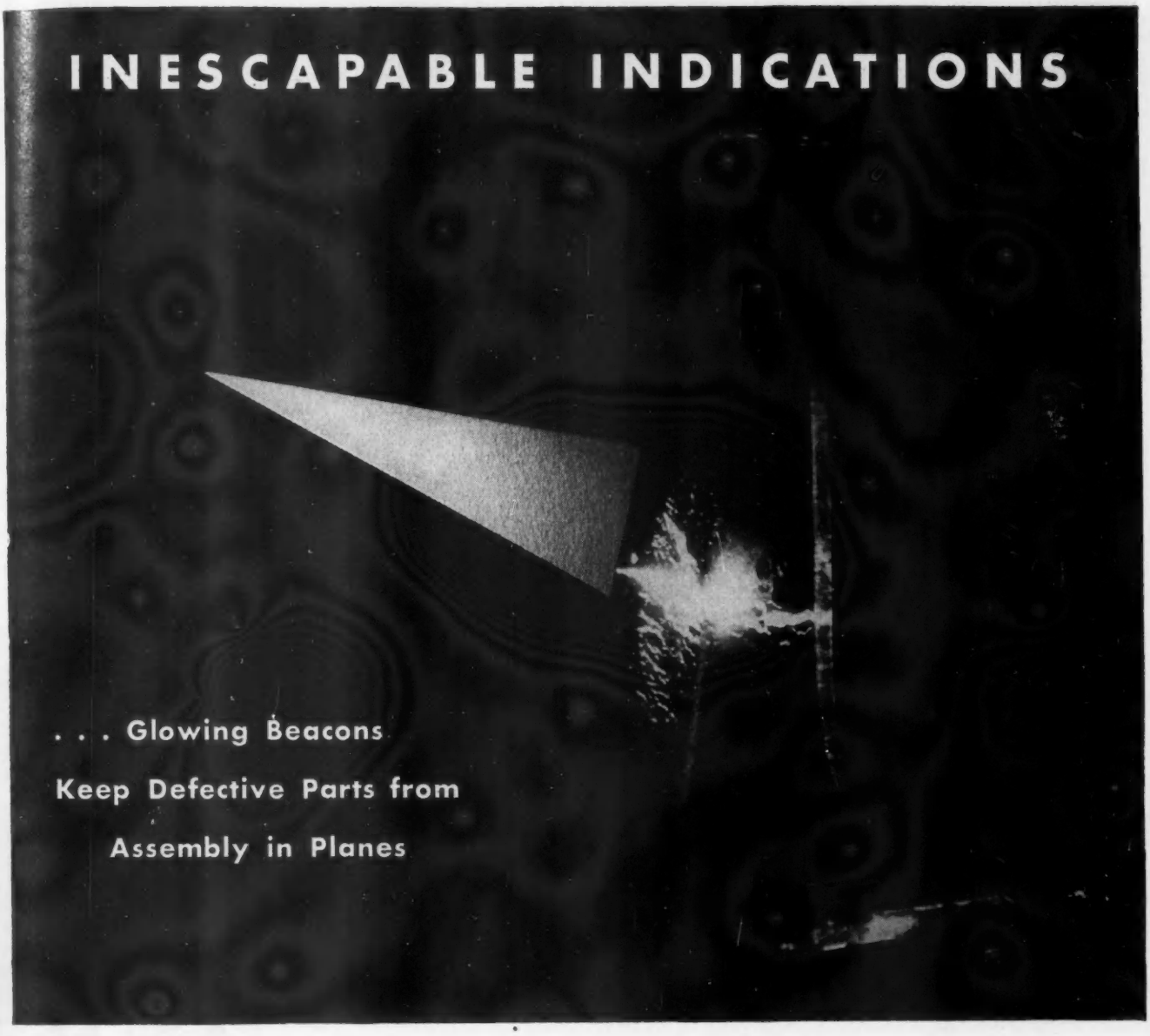


Thread milling a worm, using a Kempsmith Type "G" machine equipped with Hi-Speed Attachment, dividing head and spiral cutting mechanism.

KEMPSMITH

• *Precision Built Milling Machines Since 1888* •

INESCAPABLE INDICATIONS



● Weaknesses that threaten to develop in American armaments are discovered at home, in the factory, and not by the enemy shooting down crippled planes over the battlefield. This is a powerful factor in our military strength.

Magnaflux* Inspection of aircraft castings like the above, on a 100% basis, at production-line speeds, contributes significantly to the splendid performance record of American aviation.

The cast aluminum fitting shown here, when inspected under black light by the Magnaflux Corporation's Zyglo Method glowed with fluorescent indications of serious shrinkage cracks. To catch such defects in the foundry before passing them along offers huge savings. Not the least of these is reputation.

The Zyglo Method is being effectively used on all metals, nonmagnetic, and magnetic—particularly on aluminum and magnesium. Write for fully descriptive Zyglo Bulletin.

MAGNAFLUX RESEARCH

Since the pioneering stage of the original Magnaflux Method for steel, our engineers have sought to extend the benefits of rapid non-destructive inspection techniques in every field. For the important foundry industry special portable equipment and new procedures for more sensitive results were developed.

MAGNAFLUX CORPORATION

**Magnaflux—the Trade Mark of the Magnaflux Corporation applied to its equipment, materials and inspection methods.*

MAGNAFLUX CORPORATION

5904 Northwest Highway, Chicago 31, Illinois

New York : Detroit : Dallas : Los Angeles : Cleveland : Birmingham

Bottleneck Breakers

By pressing metal powders into the desired shape in one stroke, it has been possible for Chrysler Corporation to produce many parts for weapons in but a fraction of the time required to machine them by ordinary methods. This process also eliminates waste of precious materials and saves countless man-hours.

It all started some years before the war when Chrysler Corporation's Amplex Division began pressing "Oilite" bearings out of powdered metal and impregnating them with oil which penetrated the tiny pores of the metal itself. Once installed in hard-to-reach places in automobiles, vacuum cleaners, washing machines and other devices, these bearings provided their own lubrication without further attention.

Today almost every American-built weapon is made in larger quantity, at a saving of time and material, and functions better in action because it contains from one to scores of precision parts made by Powder Metallurgy. Such parts range from single pieces weighing 64 pounds down to tiny rivets weighing 10,000 to a pound.

Thus the science of peace has been applied to conserving the nation's manpower, materials and finances while speeding the production of better weapons.

You recall how Grandma mixed flour, seasoning and baking powder . . . then shaped and baked them into vastly different kinds of cookies, doughnuts, cakes and bread.

Powder Metallurgy is fundamentally very similar. Starting with metal "flour" so light and fluffy a breath of air would blow it away, various "recipes" are mixed, pressed in molds and actually "baked" in huge heat-treating ovens . . . to become tough, *finished parts* for many types of war equipment.

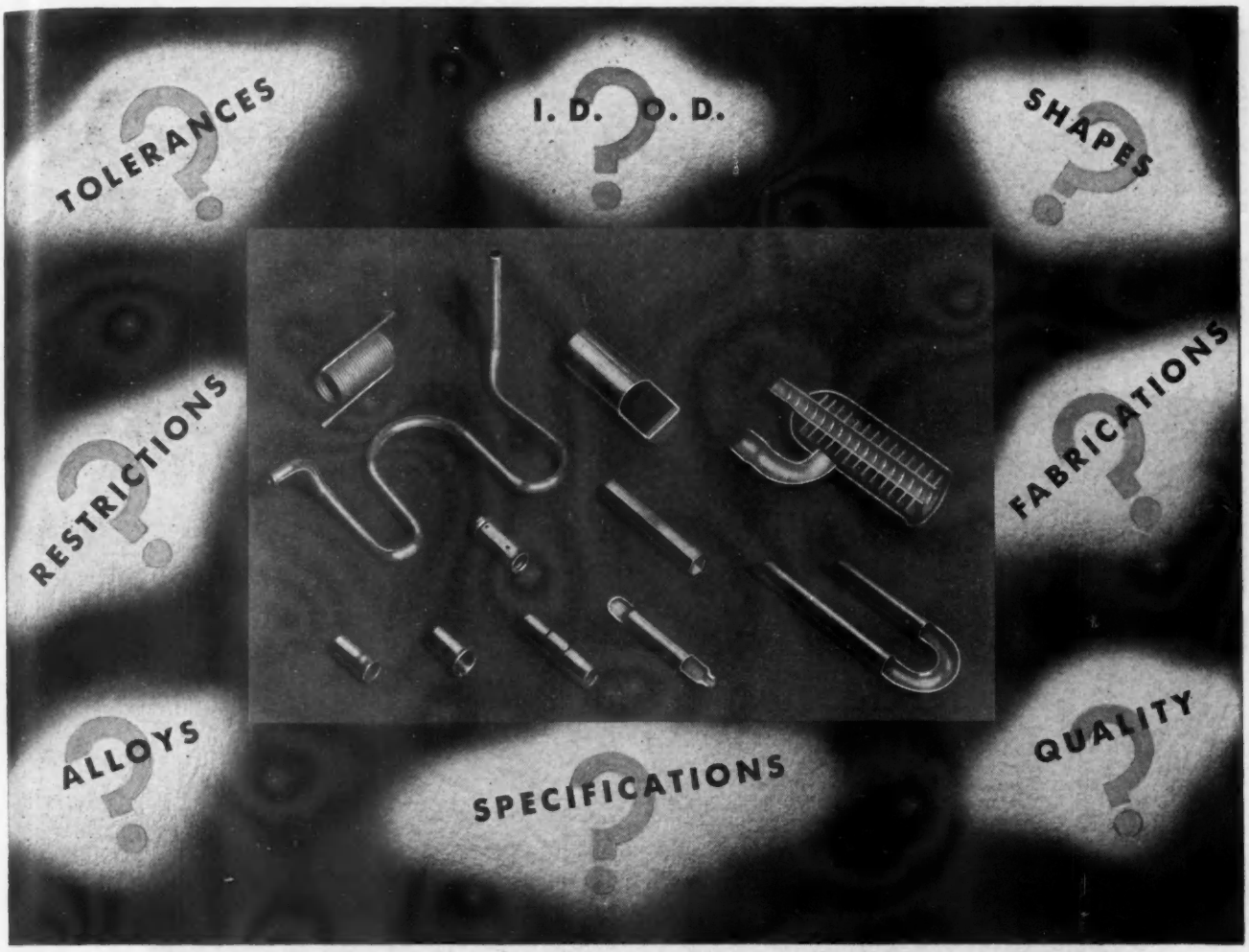
You'll Enjoy Major Bowes and His Amateurs
Thursdays, 9 P. M., E. W. T., CBS Network

LET'S ALL BACK THE ATTACK—BUY MORE WAR BONDS

Chrysler Corporation

PLYMOUTH · DODGE · DE SOTO · CHRYSLER

AIRTEMP Heating, Cooling, Refrigeration CHRYSLER Marine and Industrial Engines OILITE Powdered Metal Products



ARE THESE YOUR PROBLEMS?

Do any of these words start a train of thought?

Do the problems deal with parts that are or could be fabricated from non-ferrous tubing?

If these are your questions—whether these parts are now in production or are still in the planning stage—you will find it advantageous to consult our engineering staff which possesses a wealth of experience involving seamless tube.

You can avail yourself of this specialized experience at no cost. Let us give you this assistance.

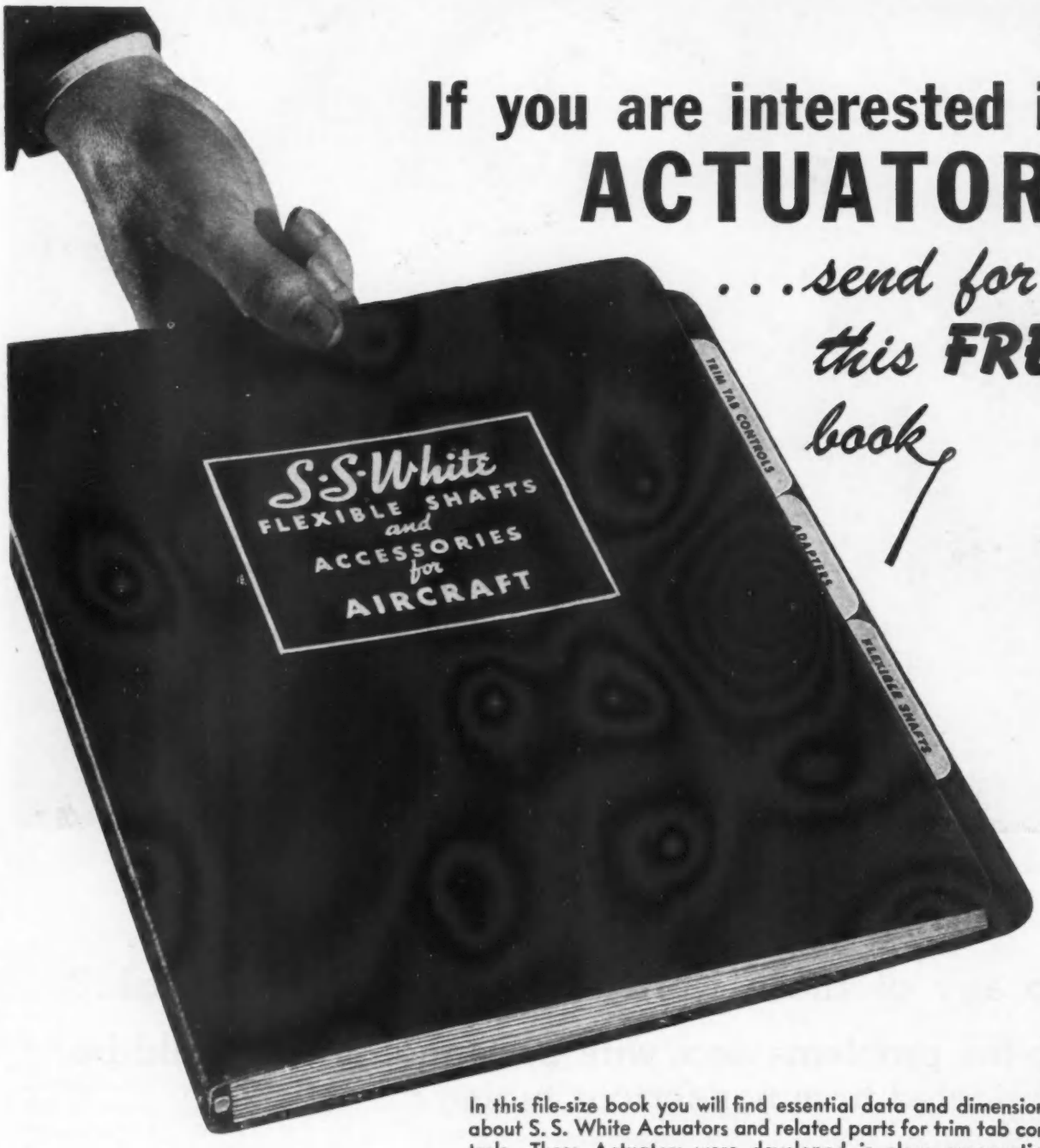
WOLVERINE
TUBE DIVISION

CALUMET & HECLA CONSOLIDATED COPPER COMPANY

1411 CENTRAL AVENUE • DETROIT 9, MICHIGAN
In Canada: UNIFIN TUBE CO., LONDON, ONT.

If you are interested in ACTUATORS

...send for this **FREE** *book*



In this file-size book you will find essential data and dimensions about S. S. White Actuators and related parts for trim tab controls. These Actuators were developed in close cooperation with aircraft engineers and have proven successful in wide application.

Similar data are also included on other flexible shaft accessories, as well as useful information and engineering data on flexible shafts for remote control and for power drives.

Your copy will be mailed on request. Write today and ask for the Actuator book.

ARMY E NAVY

S.S.WHITE INDUSTRIAL DIVISION

THE S. S. WHITE DENTAL MFG. CO.

DEPT. A, 10 EAST 40th ST., NEW YORK 16, N. Y.

FLEXIBLE SHAFTS — AIRCRAFT ACCESSORIES
MOLDED PLASTICS
MOLDED RESISTORS — FLEXIBLE SHAFT TOOLS

From these splendidly equipped research and testing laboratories and the level-headed dreamers that staff them, have come new and better steels, and improved methods for their application. Among many, these are especially notable:—

ISOTHERMAL TRANSFORMATION DIAGRAMS which permit the steel user to readily determine *in advance* the heat treatment required for various grades of steels to obtain specific results.

HIGH-STRENGTH STEELS—combining atmospheric corrosion resistance and high strength which have made possible the safe reduction of deadweight at low cost.

AUSTEMPERING—and other new and special heat-treating processes—which provide greater uniformity in heat treatment and insure improved physical properties in the heat-treated condition.

HARDENABILITY STUDIES which, by means of factors based on the composition of the steel, permit the determination of the hardening characteristics of steels and their suitability for given applications.

N. E. STEELS—Much of the major contribution Carnegie-Illinois was able to make in the development of these National Emergency Steels was based on the valuable research previously done in our laboratories—notably in the field of hardenability.

To cure "steel" headaches before they start . . . *these men work for you for nothing!*

THEIR job is to put steel through its paces. To get rid of bugs that might interfere with your production. To test, and *to find ways to improve* steel's forming, forging and machining qualities—its response to heat treatment—its weldability.

In 174 U. S. Steel laboratories, more than 1200 steel metallurgists, engineers and research workers pre-view steel and make sure—before you use it—that the steel will meet your fabrication requirements as it should, and that it will perform satisfactorily in service.

Right now, when it is vitally necessary that man-power and machinery be used to full capacity, the work of these steel specialists in developing facts that forecast performance is of prime importance in keeping your production lines running smoothly.

It is a plus service that we are proud to be able to offer to every user of Carnegie-Illinois steels. And it is free.

So, too, is the assistance of our metallurgists and the extensive laboratory facilities at their disposal in helping you get the most out of the steel now going through your shops. If you want practical help in speeding up forging and welding operations, in reducing machining schedules, in saving time in heat treating and other fabricating problems, call on us.

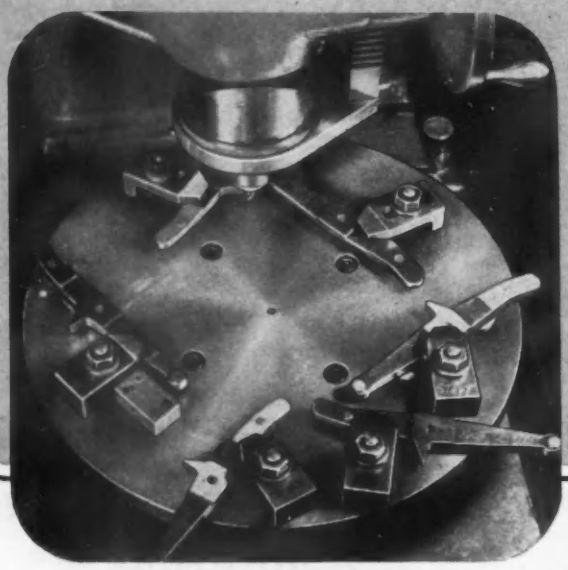
CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

UNITED STATES STEEL

"PACE" IS DETERMINED BY CONTINUOUS TABLE MOVEMENT INSTEAD OF BY OPERATOR



Six stations are used for the various profile milling operations on this part. The table rotates continuously and the operator simply unloads and reloads each station in turn while the cutter is milling the part in another station.

That's ONE REASON WHY

The THOMPSON AUTOMATIC PROFILE MILLER

Gives you more production and cuts parts costs . . . .

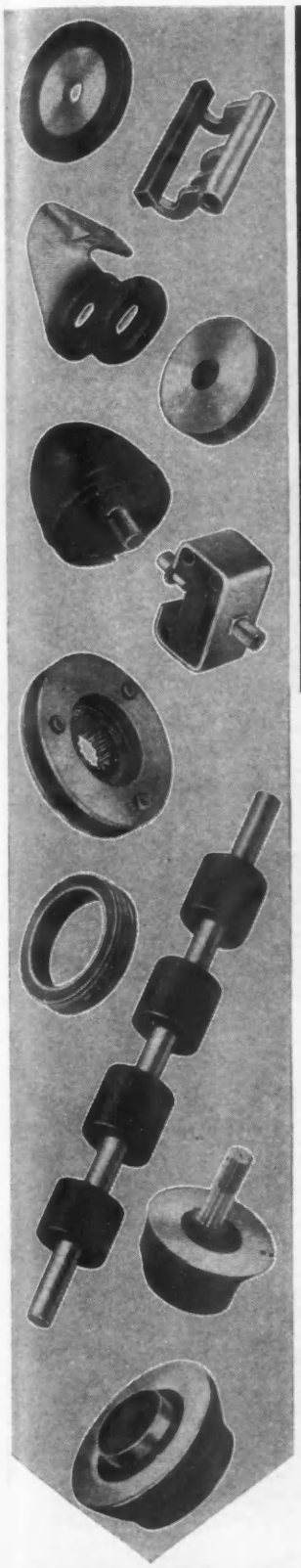
The great majority of parts requiring contour milling can be positioned on the work table of the Thompson Automatic Profile Miller two or more at a time. When there are two or more stations, the machine operator can load one station while work is being milled in another station. The milling time required is equal to or longer than the loading time . . . consequently the table moves continuously and the production rate is determined by the speed of the machine cycle rather than by the inclination of the operator. The continuous table movement presents a station to the operator for unloading and reloading at regular intervals and thus "paces" the work.

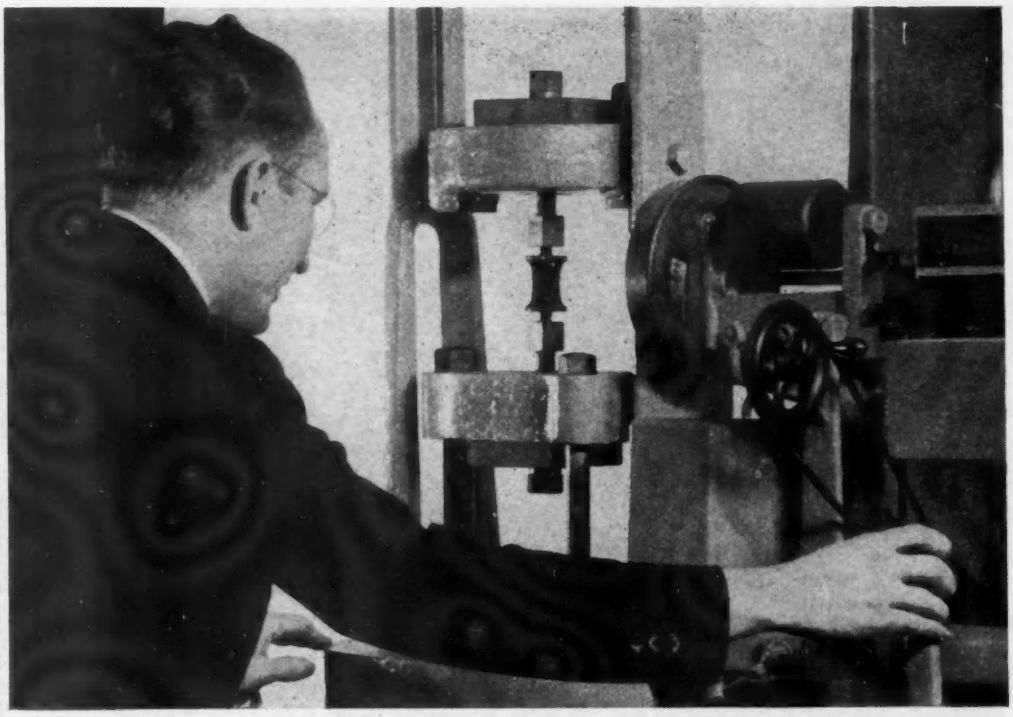
Representative of the many precision parts upon which the Thompson Automatic Profile Miller has cut costs. Write for new Bulletin 44-A which shows many more.

Because of the complete elimination of loading time and the use of automatic rapid traverse between stations, the cutter is always working a maximum amount of the total time. The fact that the operator can devote his entire attention to loading and unloading simplifies his routine. It all adds up to higher production rates and to much lower parts costs.

EARL A. THOMPSON MFG. CO.

1300 HILTON ROAD • FERNDALE, MICHIGAN





Testing synthetic rubber-to-metal adhesions on an "Olsen" testing machine which records the tensile strength of the bond in pounds per square inch.

Synthetic Rubber Joins Metal in a Long-Lasting Partnership

About a year prior to the war, it was seldom possible to obtain tensile strength exceeding 200 pounds per square inch when bonding certain widely used synthetic rubbers to even low carbon steel. And the metal parts had to be brass plated preparatory to bonding.

Now, due to special processes perfected by "ORCO" the tensile strength of synthetic rubber-to-metal adhesion has been increased to as much as 1000 pounds per square inch. And the metal parts can be high carbon steels, aluminum, or a wide variety of other metals formerly classified as "difficult" or "impracticable" for bonding with synthetic rubbers. And the metal parts do NOT have to be brass plated preparatory to bonding.

Those achievements by "ORCO" have widened the scope of rubber and synthetic rubber-to-metal adhesion parts . . . for vibration control, for resilient mountings, and for many other purposes.

A Pre-Victory Approach to a Postwar Problem

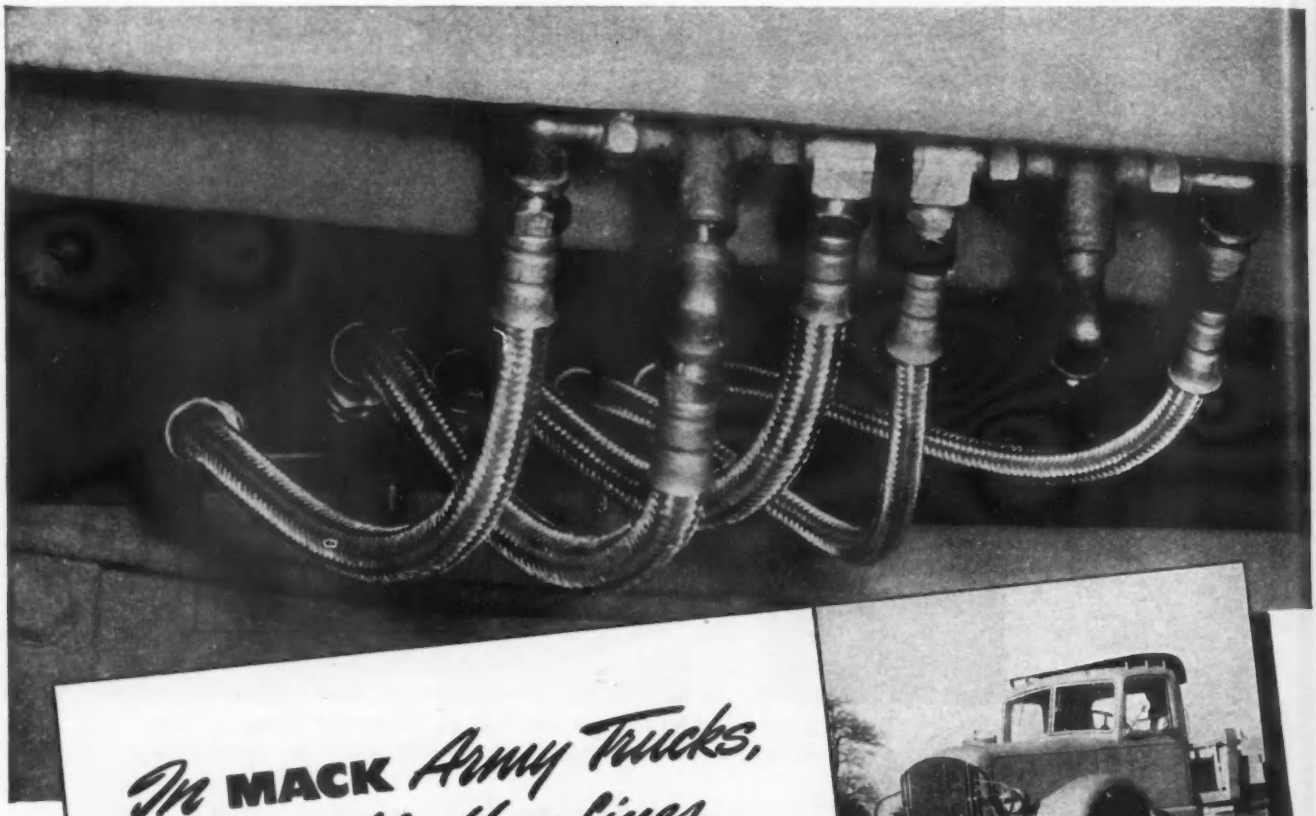
While meeting war production responsibilities 100%, many manufacturers, like The Ohio Rubber Company, are cooperating on problems which must be solved quickly when existing limitations are modified or removed. If we can be of assistance to YOU, we welcome the opportunity.

OHIO RUBBER CO

"ORCO-OPERATION"

THE OHIO RUBBER COMPANY · WILLOUGHBY, OHIO

BRANCHES: DETROIT · NEW YORK · CHICAGO · INDIANAPOLIS · WASHINGTON · CLEVELAND



In MACK *Army Trucks, Flexible Hose Lines Rely on* COMPAR

ABILITY to withstand constant flexing is an outstanding service advantage of the hose lines in Army trucks built by Mack. The lines are made by Resistoflex—the inner surface is COMPAR.

COMPAR is a unique elastic plastic that is completely impervious to attack by gasoline—either leaded or unleaded, straight or containing a high percentage of aromatics—as well as oils, both lubricating and diesel fuel. It is immune to oxidation and aging . . . is non-swelling and non-sloughing, thus assuring full flow at all times.

Resistoflex hose assemblies are constructed to give maximum strength—and still retain the extreme toughness and flexibility of the COMPAR core. As a result, Resistoflex hose offers very high resistance to shock loads and vibration.

For full details on sizes and characteristics of hose and hose assemblies, write for the Resistoflex Industrial Catalog.

GLOVES PROTECT BOTH SKIN AND METAL

Safeguards against dermatitis for the worker—protection against damage for metal parts—Resistoflex Dual-Purpose Industrial Gloves give both. Made of COMPAR, the same elastic plastic that gives Resistoflex hose its unique qualities, these gloves are impervious to most of the commonly used organic solvents. Containing no sulphur, they will not tarnish highly polished parts, are ideal for delicate inspection jobs. Write for full details.

RESISTOFLEX

HOSE AND HOSE ASSEMBLIES FOR HYDRAULIC OILS AND VACUUM, FUELS AND LUBRICANTS, ORGANIC SOLVENTS, PAINTS AND LACQUERS, THINNERS, REFRIGERANT, NATURAL AND MANUFACTURED GASES—LABORATORY TUBING—DIPPED AND MOLDED MECHANICAL GOODS—COATINGS, SOLUTIONS AND PROTECTIVE CLOTHING

RESISTOFLEX CORPORATION, BELLEVILLE, NEW JERSEY

Automatic Recessing—

The "KNOW HOW" of Grooving

WHERE grooves or recesses are to be cut, whether internal or external, SCULLY-JONES AUTOMATIC TOOLS will speed up and increase your production. Tools of this type may readily be used in drill presses, thus freeing more urgently needed machines. ★ Fine adjustments are provided for controlling diameter and the location of grooves. ★ On some styles, the use of various interchangeable cutters in one body, make it adaptable to different recessing operations.

FACING AN INTERNAL BOSS ON "JEEP" MOTOR CASTINGS WHERE OBSTRUCTION USUALLY CAUSES DIFFICULTY.

FORMED RECESSES MADE IN ONE OPERATION ON DETONATOR BUSHINGS OF LARGE CALIBRE MOTORIZED ARTILLERY RIFLES.

GROOVE FOR THREAD CLEARANCE CUT ON ANTI-AIRCRAFT PROJECTILE WITH AUTOMATIC "NECKING" TOOL.

CASTING OF PART FOR ARMY TANK ON WHICH TWO RECESSES ARE MADE AT ONE TIME.

RADIUS CUT MADE IN PART FOR STEERING GEAR MECHANISM OF POWER TORPEDO BOAT.

BOTH INSIDE AND OUTSIDE CLEARANCE GROOVES CUT IN ONE OPERATION ON OIL TANK CAPS FOR SUBMARINES.

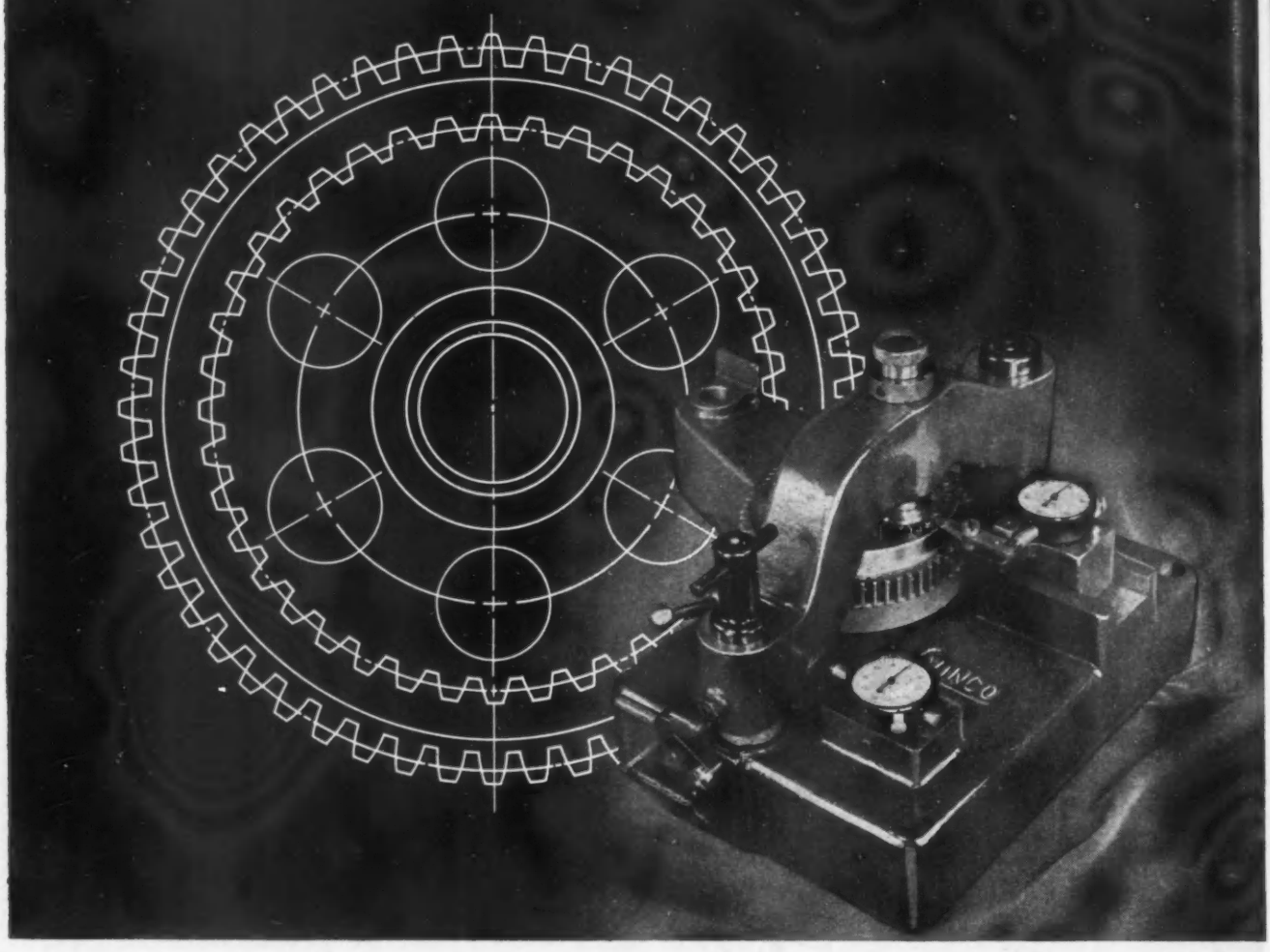
SNAP-RING GROOVES CUT IN WRIST PIN HOLE OF AIRPLANE PISTONS.

HEAVY UNDERCUT AND CHAMFER MADE IN ONE OPERATION ON LARGE NAVAL GUN PROJECTILE.

SCULLY-JONES AND COMPANY

1901 SO. ROCKWELL STREET • CHICAGO, ILLINOIS. U.S.A.

A ~~CHAIN~~ Gear IS ONLY AS STRONG AS ITS WEAKEST ~~LINK~~ tooth



Appropriate apologies for paraphrasing an old proverb! But isn't it the truth?

There is no provision today for error. There is too much at stake. Highly mechanized warfare staged against a bitter, ruthless enemy demands a constant flow of war machines, flawless in construction and exact in every detail. Gears furnish the vital motive power for these engines of destruction—gears decide whether we can out-shoot, out-fly or out-maneuver the enemy. That is the gear maker's responsibility.

VINCO also has a responsibility: to provide speedy, accurate methods of checking the various phases of gear production. VINCO GEAR ROLLING FIXTURES, VINCO MASTER GEARS and the VINCO INVOLUTE CHECKER are doing a masterful job in helping to maintain peak gear production.

The above insert is a Vinco Gear Rolling Fixture designed to check backlash and run-out on an internal gear—one of hundreds of specially designed gear rolling fixtures that are proving invaluable aids to leading manufacturers in maintaining a high production of precision gears.

V I N C O C O R P O R A T I O N
8869 SCHAEFER HIGHWAY - - DETROIT 27, MICHIGAN

SALES OFFICES
NEW YORK and CHICAGO

MILLIONTHS OF AN INCH FOR SALE BY V I N C O

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Hub Gages • Built-up and Special Gages • Gear Rolling Fixtures • Spline and Index Fixtures • Hydraulic Power, Control, Utilization and Distribution Units • Engineering, Design and Development.

MAKE 'ER LAST!

Heaven only knows when you'll get a new one

YOU of course are taking every precaution to make your present car last for the duration.

One way to help insure this is to cushion it against road-pound, twist and consequent wear, with soft-action HOUDAILLE* Shock Absorbers.

In the unprejudiced judgment of engineers, the hydraulic principle is scientifically right for shock absorber design. And Nature too agrees—otherwise she wouldn't put fluid in your joints, and around your heart and lungs.

This makes you live longer. And the same sound principle will likewise make your car live longer.

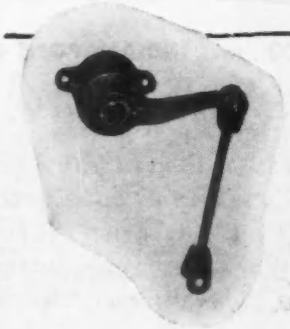
Remember, Houdaille Hydraulic Shock Absorbers are double-acting. They neutralize up-and-down shock, and also act to prevent chassis twist and car swerve.

Especially are Houdaille Hydraulic Shock Absorbers protective to your precious, irreplaceable tires.

From time to time, let a specially trained Houdaille service expert inspect your Houdaille Shock Absorbers—this is highly important to your car's life.

Should your shock absorbers require basic attention, your Houdaille service expert will replace them with genuine factory rebuilt units, on the car manufacturer's exchange plan.

HOUDE ENGINEERING DIVISION OF
HOUDAILLE-HERSHEY CORPORATION
Makers of Hydraulic Controls
BUFFALO 11, NEW YORK



BUY U. S. WAR BONDS

For a smoother ride

HOUDAILLE*

Hydraulic Double Acting

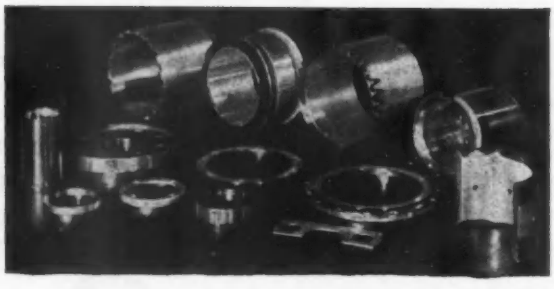
SHOCK ABSORBERS

* *Pronounced* "HOO-DYE"

Silver is Now a Fighting Metal

NOW—silver is a fighting metal—not a "softie"—when it goes up into the air. It is doing a great job in Mallory aviation bearings: packing endurance and dependability into our fighter and bomber planes.

Through the Mallosil* process of bonding dissimilar metals, Mallory silver-bonded bearings, rocker arm bushings, pinion races and other vital engine parts are meeting incredible stresses and strains encountered in seven-mile-a-minute speeds, breathless dives, and hair-raising maneuvers.



Mallory has developed the silver-bonded bearing to precision quality with a hitherto unknown uniformity and dependability. This permits volume production of bearings with the narrowest tolerances ever called for—and with virtually no variations. It is the reason why aviation engine manufacturers have come to depend upon Mallory as the reliable source of supply.

Obviously such wartime developments mean much to future commercial aviation. But progress does not stop here. Wherever heavy duty bearings are used, Mallory bearings have a gain to offer to design engineers because of their ability to take high peak loads.

Although Mallory production is concentrated on the war effort, we are ready to cooperate in planning for the future. Mallory engineers will be glad to discuss your problems with you.

*Reg. U. S. Pat. Off.

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

Make Your Dollars Fight Too—Buy More War Bonds

P.R.MALLORY & CO. Inc

MALLORY

SERVES THE AVIATION, THE AVIATION-INSTRUMENT AND THE AVIATION-COMMUNICATION FIELD WITH WELDING TIPS, THE MALLOSIL* PROCESS—BEARINGS, SPECIAL ALLOYS, ELECTRICAL CONTACTS, VIBRATORS, VIBRAPACKS,* CONDENSERS, ROTARY AND PUSH BUTTON SWITCHES, ELECTRONIC EQUIPMENT, COMMUNICATIONS HARDWARE, RECTOSTARTERS*

There are other kinds of dunking, too

FOR instance, resilient materials used in a plane may be continuously dunked in oil or gasoline. And these materials may absorb petroleum products just as readily as a doughnut absorbs coffee.

The next time you dunk a doughnut let it remind you that oil seals, hose, packing, gaskets, grommets, diaphragms, and all resilient parts used in the presence of oil and gasoline may absorb considerable weight not included in original design calculations. And this dead weight added to thousands of resilient parts in a single plane may seriously handicap its performance.

However, Hycar synthetic rubber with its light weight and its superb resistance to oil to keep it light, gives protection against excessive dead weight not offered by any other comparable material. Hycar is 15% to 25% lighter than many other synthetic rubbers, and retains this important quality throughout its long life. Further, oil-swell can be closely controlled to insure dimensional stability of parts.

Hycar has an operating range of −65° to +250° F. and abrasion resistance 50% better than natural rubber. Unlike many other oil-resistant synthetic rubbers, Hycar has a minimum tendency to cold flow after taking the initial deformation, even at elevated temperatures.

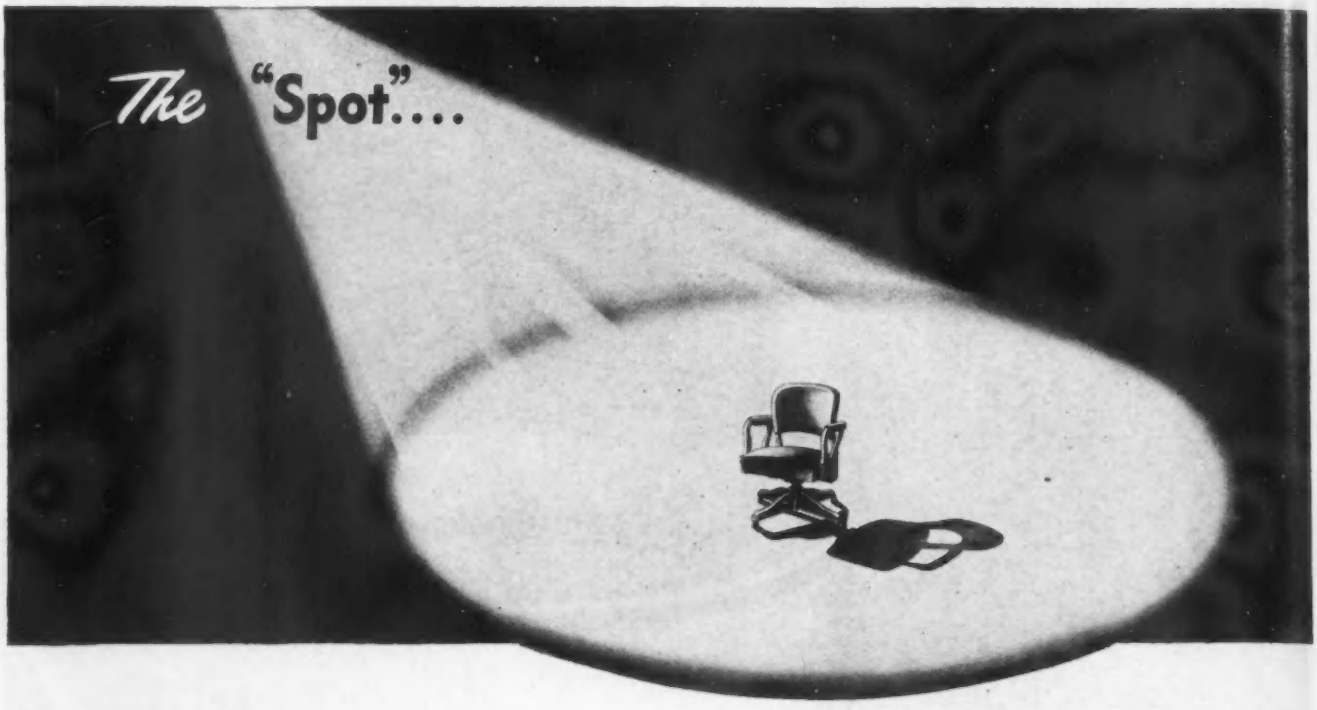
These are qualities you need in resilient materials used in the presence of oil and gasoline. Let our technical service staff help solve your individual problems. *Hycar Chemical Company, Akron 8, Ohio.*

Hycar

Reg. U. S. Pat. Off.

LARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

Synthetic Rubber



Waiting for Executives who neglect Postwar Planning NOW!

SNYDER can save you time, money and effort by helping you plan production and production machines...WHEN YOU PLAN YOUR PRODUCT

Sure you're busy. But, to postpone the planning of postwar production "until the pressure eases a bit" is to invite trouble. And when that trouble arrives, you'll have no more time than you have now.

Maybe your postwar product *is* "all set" and you figure that this fact gives you a breathing spell. Actually, this should be your No. 1 reason for pressing forward with production plans. A roll of drawings in the vault, and tool room models on the shelf are cold comfort to a dealer clamoring for merchandise.

Also, planning production and designing and building production machines often is a much bigger job than planning the product. It all takes time and time grows increasingly precious as the months go by.

The ideal way, of course, is to plan your production when you plan your product. By doing so, it often is possible to make comparatively simple alterations in product design or in machine design which greatly improve production efficiency and proportionately reduce costs.

Snyder's 20 years experience in designing and building special-purpose machines for many types of industry is at your service *now*, ready to help you with your production plans.

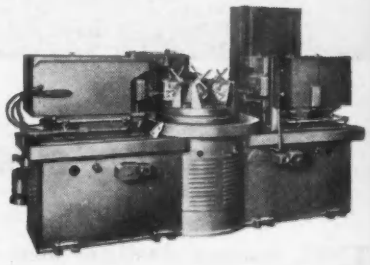
With such plans completed, your machines will be ready to start through the Snyder plant as soon as present restrictions are lifted and delivery to you can then be accomplished in the shortest possible time.

We invite you to write us in full confidence. *Snyder Tool & Engineering Company, 3400 E. Lafayette Ave., Detroit 7, Michigan.*

SNYDER

DESIGNERS AND BUILDERS OF SPECIAL-PURPOSE MACHINES FOR HIGH PRODUCTION AT LOW UNIT COST

PLAN Your PRODUCTION when you PLAN Your PRODUCT



SNYDER KNOWS HOW

This unique 3-way, hydraulic, special-purpose machine is designed and built by Snyder for keyseating and milling valve rocker covers for aircraft engines.

Normally this would require three operations on individual machine set-ups and six handlings of each part.

On this machine each pair of parts is completed in one operation and one handling, thereby maintaining greater accuracy of relationship in the two keyways, saving time, reducing labor fatigue.

Operating mechanisms are mounted on main slides which, in rear position, allow ample clearance for indexing.

Keyseating tools are actuated through a crank mechanism and are fed up and down by hydraulic cylinders through a feed cam. The milling cutters on rear unit are fed into the work in the same way.

The tools on side units feed into work while rear unit cutters cut clearance pocket for second slotting tool.

20 Years of Successful Co-operation with Leading American Industries

DISSTON offers

Standard Alloy Steel for Airplane Parts...

★

Standard Alloy Steel of Gun Quality...

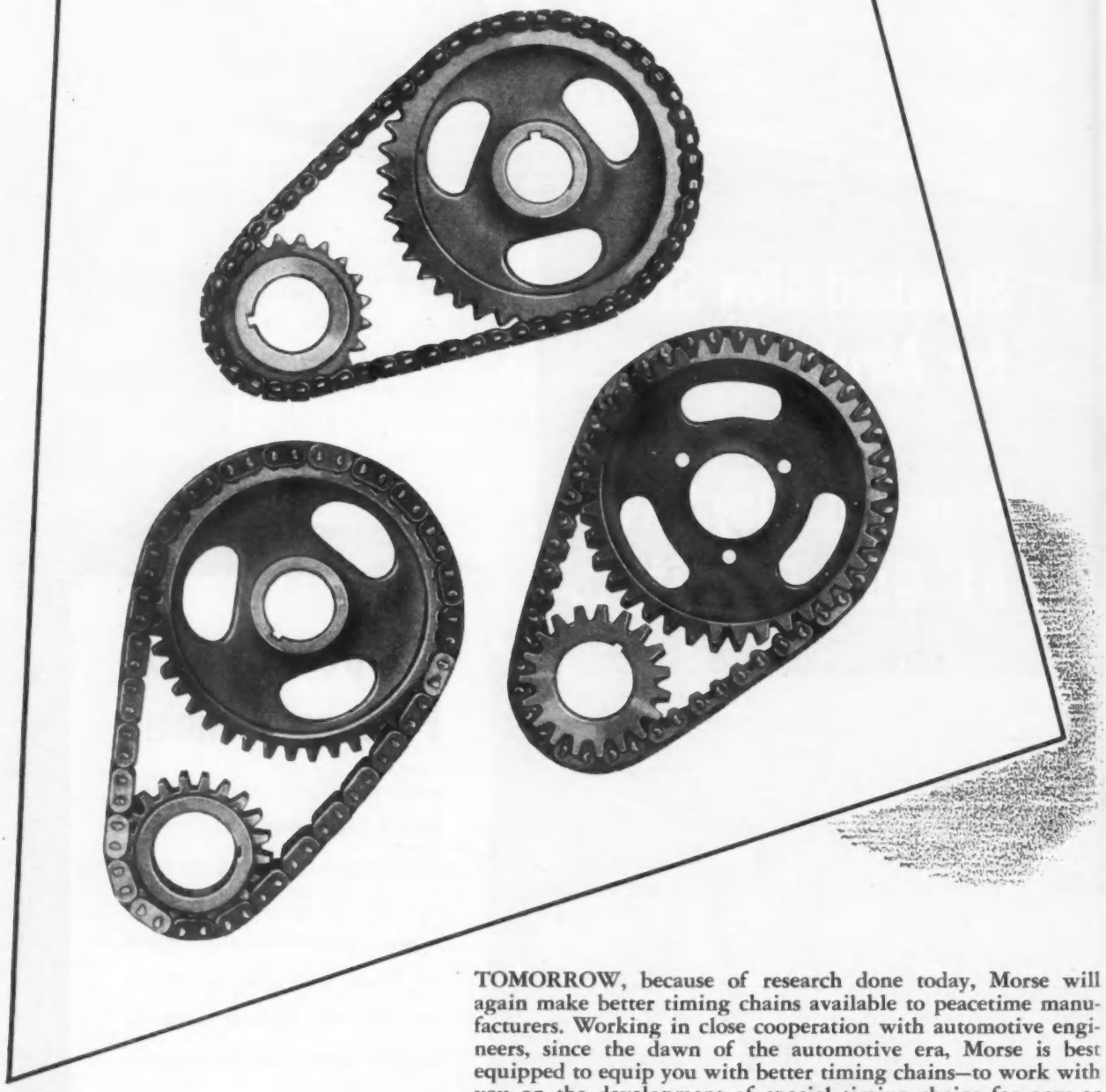
These fine Disston Steels are produced by modern tool steel practice in electric furnaces, under precise control and expert supervision.

Cooperation on Postwar Planning

The exceptional experience and broad background of Disston metallurgists and engineers in the manufacture and application of special tool and carbon steels are available — without obligation — to help you on any anticipated postwar problems. Write fully.

HENRY DISSTON & SONS, INC., 531 Tacony, Philadelphia 35, Pa., U. S. A.

MORSE panel for the future

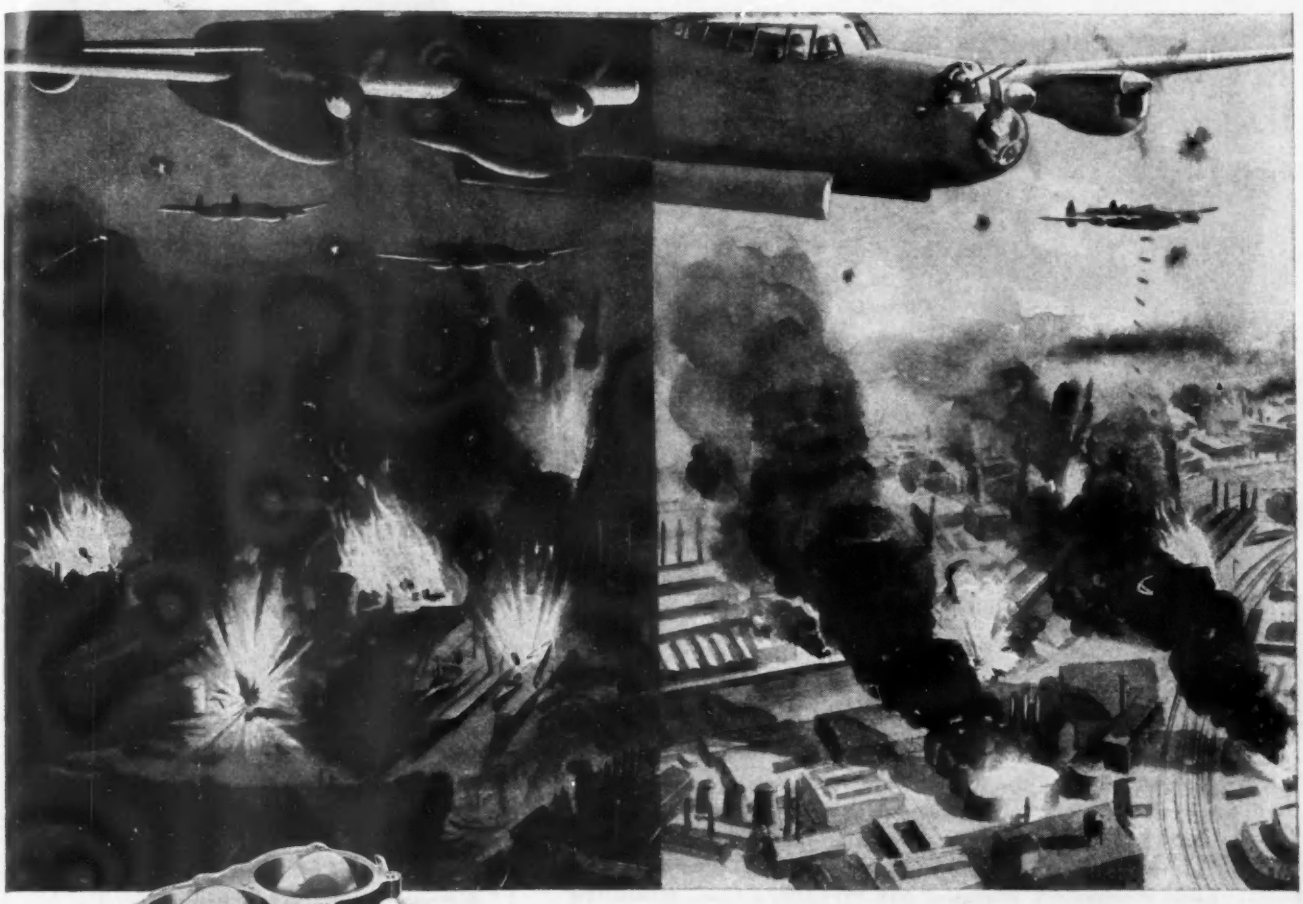


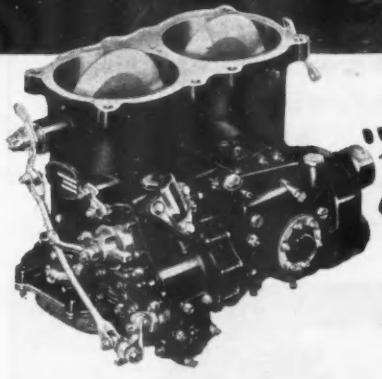
TOMORROW, because of research done today, Morse will again make better timing chains available to peacetime manufacturers. Working in close cooperation with automotive engineers, since the dawn of the automotive era, Morse is best equipped to equip you with better timing chains—to work with you on the development of special timing chains for new or special applications.

SPROCKETS CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE Roller and Silent CHAINS

MORSE CHAIN COMPANY • ITHACA, N. Y. • DETROIT, MICH. • A BORG-WARNER INDUSTRY





"Round-the-Clock" Bombing

Demands Dependable Carburetion

On the Lancasters, Mosquitoes, and other bombers of the Royal Air Force that have blasted Germany by night — and on the Flying Fortresses and Liberators of the American 8th Air Force that have unceasingly attacked German targets by day — Stromberg* Injection Carburetors provide unfailing power flow regardless of flying conditions. The efficiency of these carburetors in maintaining the right air and fuel mixture conserves gasoline and constantly lengthens the range of bombing missions. Stromberg injection carburetion improves the performance also of fighters, trainers and transports.

**Trademark of Bendix Aviation Corporation*

STROMBERG*

INJECTION CARBURETOR

The Stromberg Aircraft Carburetor is an important member of "The Invisible Crew"... precision instruments and controls, which more than 30 Bendix plants from coast to coast are speeding to our fighting crews on world battle fronts.

BENDIX PRODUCTS DIVISION
SOUTH BEND, INDIANA

THE INVISIBLE CREW
Precision Equipment by
Bendix Aviation Corporation

FEDERAL PRESSES

SAVE MANPOWER

—Time and Money, Too!

Federal Dial Feed Presses are now being used for hundreds of time-saving, work-saving, money-saving operations in factories throughout the country—for their versatility is limited only by the tooling skill and resourcefulness of the production engineers. Federal Dials are easily indexed to any part of the crankshaft revolution, from 90 to 180 degrees, giving long or short dwell of the dial. Positive-locking mechanism smooths out the dial action, permitting unusually high speeds with exceptional accuracy, and assuring additional safety for the operator. Cannot skip or coast by stations. And on some jobs the dial feeds can be equipped with automatic loading and ejector mechanisms which often increase production speed as much as 4 to 5 times over hand operations. Available in eight sizes. *Write today for new catalog* which illustrates and describes the complete line of Federal Presses.

THE FEDERAL PRESS CO.

505 Division Street, Elkhart, Indiana

★

ORDER NOW FOR WAR AND POST-WAR PRODUCTION

Federal Presses will be just as effective in overcoming tomorrow's peace-time production problems as they are in today's war production. It will pay you to order now, for today's needs or prompt post-war delivery.

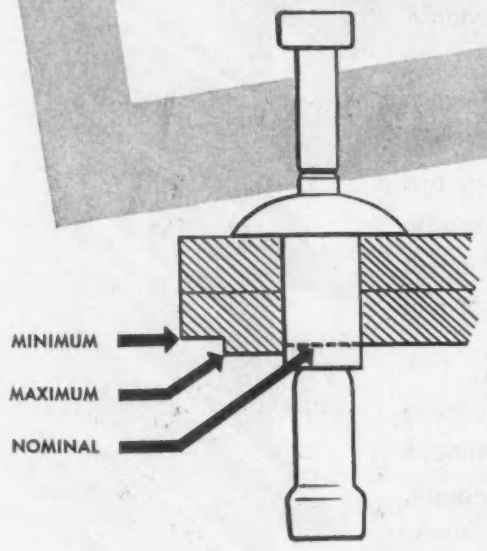
FOR MANY JOBS

- Burnishing
- Staking
- Broaching
- Marking
- Forming
- Assembling
- Combinations

Below—Rotary switches are speeded to completion at P. R. Mallory and Co., with help of Federal Dial Feed Presses.

FEDERAL DIAL FEED PRESSES

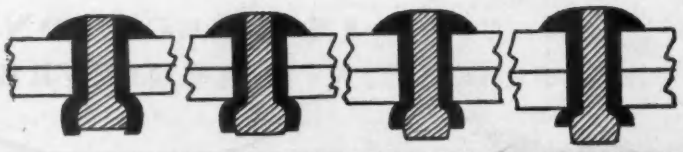
CHERRY BLIND RIVETS GIVE YOU GENEROUS TOLERANCES IN GRIP LENGTH



Material thickness isn't critical with Cherry Rivets. The grip length can vary up to a sixteenth of an inch and still hold perfectly. Cherry Rivets offer unusually broad tolerance in hole size, too. You have a latitude in working with Cherrys which is exceptional for blind rivets. You get good results under a wide variety of conditions—not only for blind riveting but anywhere you want a strong, firm, neat joint.

Cherry Rivets meet the requirements of the materials—metals, plastics, soft, pliable or brittle materials.

This diagram shows materials of different thicknesses joined with Cherry Rivets of the same length and all are held with perfect satisfaction.



Get this manual. It shows how easy Cherry Rivets work. Here's a book which everyone who uses blind rivets should have for handy reference. It may furnish the right answers to many tough production problems. Please specify Manual B-44.

CHERRY RIVETS, THEIR MANUFACTURE AND APPLICATION ARE COVERED BY U.S. PATENTS ISSUED AND PENDING

Cherry Rivet *Company*
LOS ANGELES, CALIFORNIA

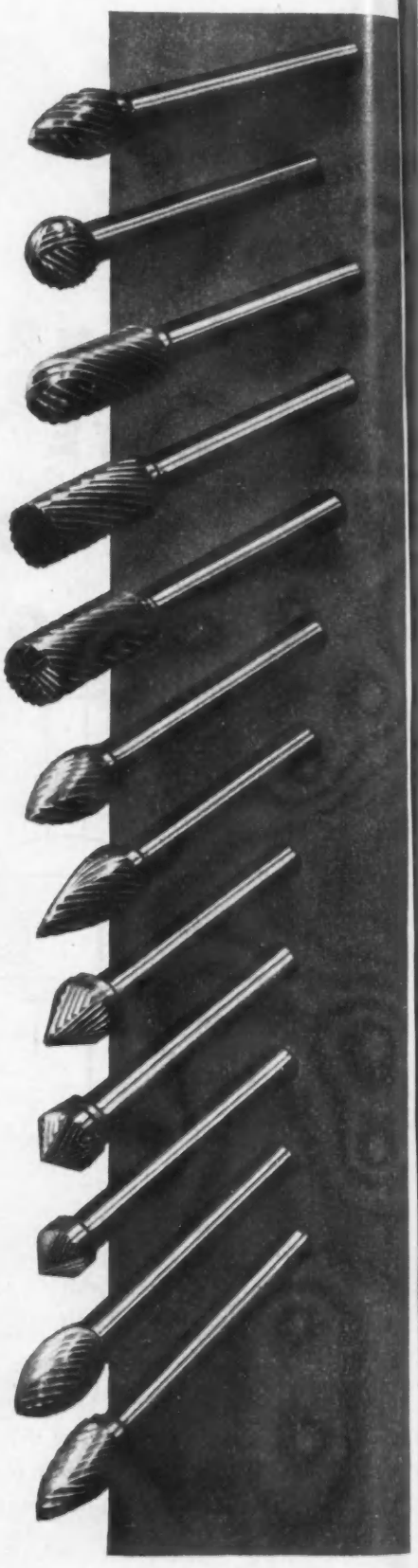
These are the Present
STANDARD SHAPES of CARBURS

INDUSTRY'S FIRST CEMENTED-CARBIDE ROTARY FILES

EACH of the tools illustrated is available in either four or five sizes—providing a range that meets almost any production requirement for deburring, filing or cutting. In addition to these, special shapes are being produced to meet the specific needs of many customers.

Since Carburs were first introduced, a number of performance reports have been received from the plants where they have been in constant use. These reports prove that these rotary files—which have teeth ground from the solid cemented-carbide—are providing up to 100 times greater life than high speed steel files. They are greatly reducing deburring, filing or cutting time per part because of the higher speeds at which they can be run and the less frequent need for replacement. Another important feature noted is that tool sharpening is reduced in proportion to the life of the tool.

You, too, will recognize these and other advantages once you have used Carburs in your production. Prompt delivery on all standard shapes and sizes can now be promised. Let us send you full information.



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LIGHTNESS

one of the six measurements of aircraft engine air filters

In 1940, the filter for a 1,250 horsepower airplane engine weighed nine pounds. Today, the Air-Maze filter for that engine weighs 1.6 pounds.

If this lightness were attained without consideration for efficiency, durability and dust capacity, it would not be remarkable. But lightness in aircraft filters is not a goal in itself.

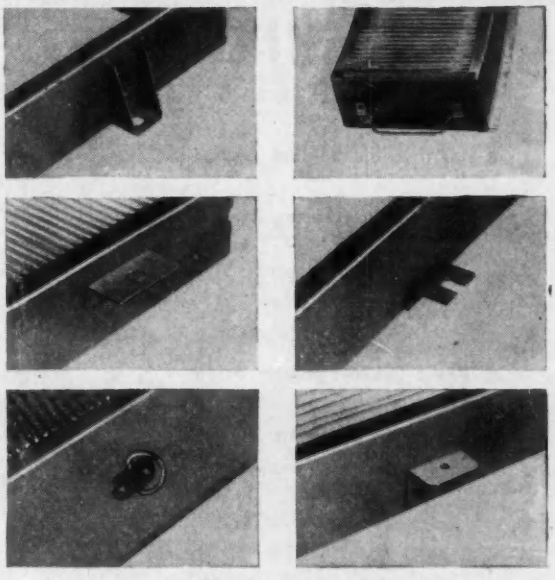
Honest engineering calls for the utmost efficiency, the longest life, the largest capacity—with the least possible weight.

This is the basis on which Air-Maze has engineered lightness into its filters. Aircraft filter research that dates from the twenties led to the development of a new kind of media, to the use of lighter, strong materials, to new designs and higher velocities.

The lightness of Air-Maze aircraft filters springs from this sound, creative engineering. It is not won at the expense of those other qualities that make aircraft filters so effective in lengthening engine life and reducing maintenance.

FACTS about aircraft engine air filters . . . types, improvements, performance data. Send for your copy of "Aircraft Engine Air Filters" now.

INSTALLATION DEVICES AVAILABLE



Air-Maze aircraft filters can be furnished with various attachment devices on order, offering both economy and time savings. Send for Bulletin 113.

AIR-MAZE CORPORATION • *Engineers and Manufacturers* • **CLEVELAND 5, OHIO**

Representatives in Principal Cities • *In Canada:* **Williams & Wilson, Ltd., Montreal, Quebec, Toronto, Windsor**

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AIR-MAZE

SPECIALISTS IN AIR FILTRATION

FAST—EASY
MOVEMENT OF MATERIALS ALL ALONG THE PRODUCTION LINE

NO
STRAINING
TUGGING
PULLING
***Nor* PUSHING**

- Positive mechanical brake
- Controls in steering handle
- Forward and reverse speeds
- Front wheel power drive
- Shockless hydraulic lift with easy foot control

★Handling of this load is just as easy as it looks. More than that it is faster than any picture can show — tons just flow along — the operator accomplishes more each day with little effort — everything systematically accomplished — there's no tiring effect on the operator because there is no heavy handling or hard pulling to do.

This battery powered equipment is adaptable to short hauls and for use in elevators, narrow aisles, and areas where floor loads are restricted. It supplements larger industrial trucks to effect a complete handling system.

Write for Details

MANUFACTURERS FOR OVER THIRTY FIVE YEARS *Electric Propelled* INDUSTRIAL TRUCKS

AUTOMATIC TRANSPORTATION CO.
DIV. OF THE YALE & TOWNE MFG. CO.
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Putting Teeth in a 70-Ton Bite

TAKE SIX TONS of fighting fury—wrap it around 2,000 horsepower—pull it seven miles up, at more than 400 m.p.h.—that's just a rough idea of the work a propeller does on a Thunderbolt or similar stratosphere fighter. There can be no margin for error in manufacturing these "props" . . . *Life and Victory ride on their performance.*

Successfully producing non-ferrous metal and steel "prop" blades to withstand a 70-ton pull at high speeds means intensively double-checking for fatigue stresses which "pop" up occasionally and eliminating this threat of failure before it actually happens in combat.

A McAleer *tailored-to-the-job* greaseless type composition and finishing method helped solve the problem. Not only were the occasionally microscopic fatigue stresses revealed, but the unbelievably smooth finish obtained, made it possible to feather the "prop" blades with practically no coefficient of air friction at high speeds.

McAleer Finishing Engineers were ready for this assignment. Long before the urgency of national peril, McAleer was busy helping aircraft engine manufacturers obtain a similar type finish on operating parts of the power plants that actually drive these propellers.

Pass YOUR hard-to-solve finishing production problems on to McAleer. Our broad experience in production finishing procedure and product improvement through finishing, can help you materially in meeting your war production finishing contracts.

Be the material, metal, plastic or wood—if the job can be finished better, faster, more economically, McAleer "know-how" will find the way.

McAleer MANUFACTURING CO.

Manufacturers of Quality-Controlled Finishing Materials, Military Aircraft Sub-assemblies and Pyrotechnics . . .

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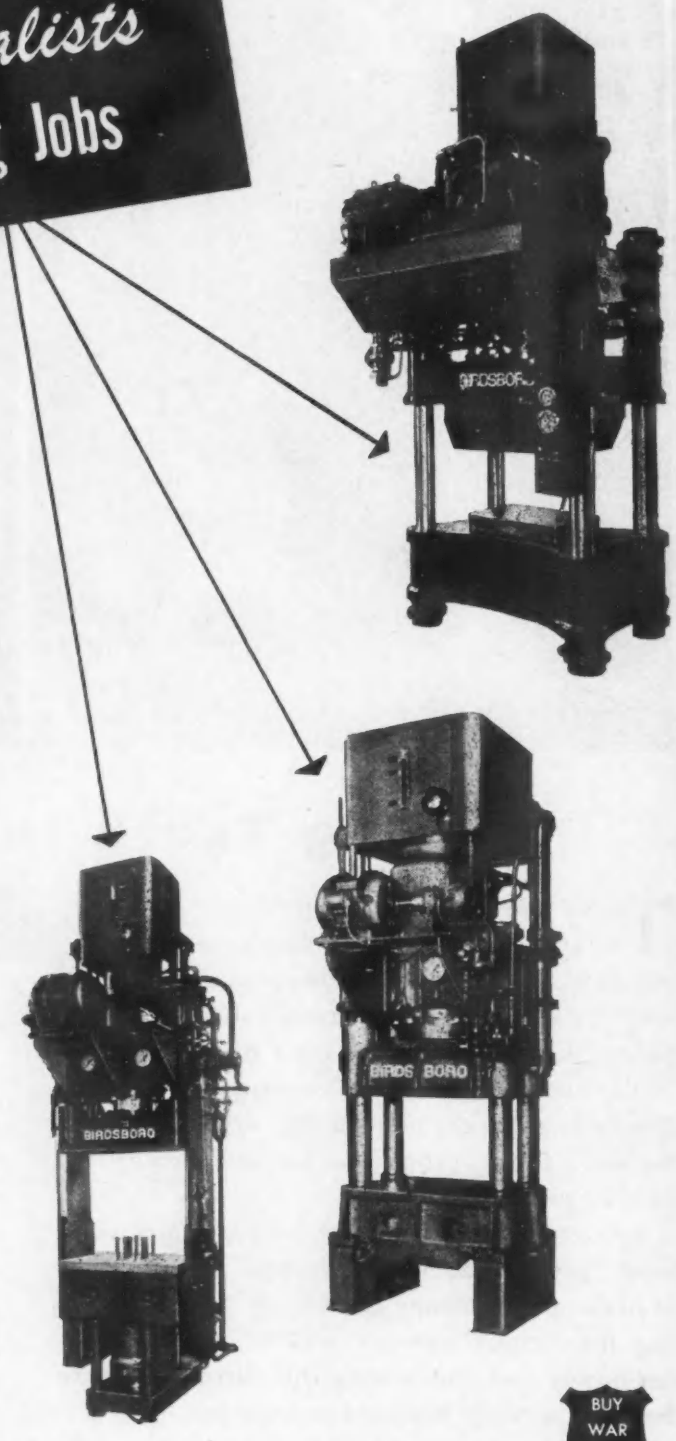
Use These *Specialists* For Small Pressing Jobs



A special segment of the Birdsboro hydraulic press line is this 150 to 750-ton group, built for the aircraft and allied metal working industries to mass-produce small metal parts.

It will pay you to consult Birdsboro the next time you need a small part press. Our experience in helping hundreds of other hydraulic press users solve their problems is ready to serve you.

For additional information write for the Birdsboro Hydraulic Metal Working Press Catalogue.

Birdsboro Hydraulic Metal Working Presses are built in sizes from as small as 150 tons to as large as 5500 tons.

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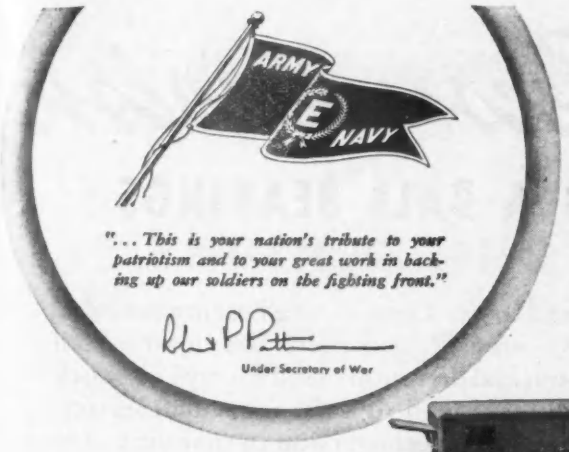
BIRDSBORO STEEL FOUNDRY & MACHINE COMPANY • BIRDSBORO, PA.

BIRDSBORO
HYDRAULIC PRESSES


ARMY
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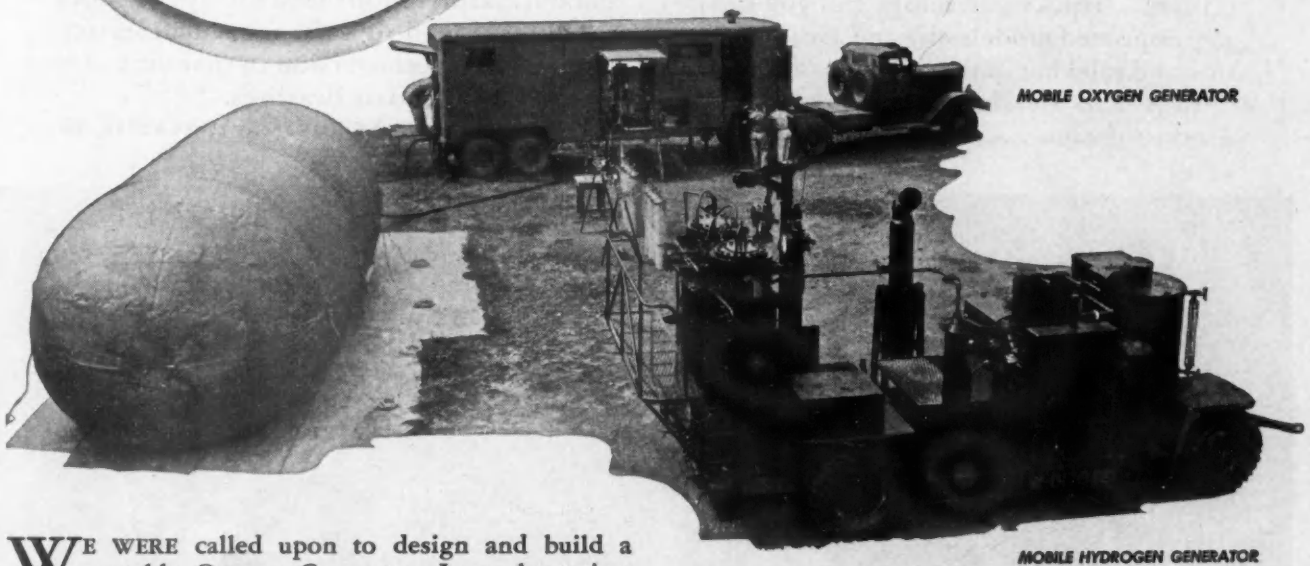
NAVY
"... This is your nation's tribute to your patriotism and to your great work in backing up our soldiers on the fighting front."
Under Secretary of War

Serving the Armed Forces



MOBILE OXYGEN GENERATOR

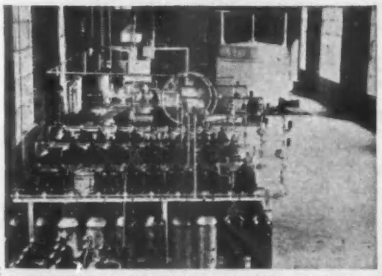
MOBILE HYDROGEN GENERATOR

WE WERE called upon to design and build a portable Oxygen Generator. In a short time Independent Engineers completed the first Mobile Oxygen Generator capable of producing 99.5% pure oxygen and charging high pressure oxygen cylinders in the field.

There are now many of these Mobile Oxygen Generators supplying oxygen to our Armed Forces in all theaters of this war.

WE WERE also called upon to design and build a portable high pressure Hydrogen Generator. This was the first portable high pressure Hydrogen Generator capable of producing hydrogen and charging high pressure cylinders in the field.

OXYGEN GENERATOR—This is a view of a typical commercial Oxygen Generator installation in operation. This plant produces 750 cubic feet per hour and up of 99.5% pure oxygen.



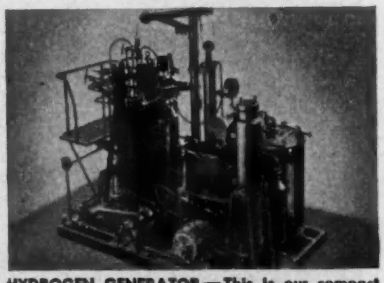
ACETYLENE GENERATING PLANT — A typical installation of our continuous generator and charging plant.

After Victory....

We will be building Oxygen and Hydrogen Plants for commercial users; also, Acetylene Generating Plants, High and Low Pressure Cylinder Testing Equipment, Acetylene Cylinders, etc.

We will be glad to go over your requirements and assist you in any way possible. If you are directly or indirectly serving the Armed Forces, it may be possible to obtain this equipment now. Address your inquiries to Sales Engineer, Department A.

INDEPENDENT ENGINEERING Co.
INCORPORATED
O'FALLON ILLINOIS



HYDROGEN GENERATOR — This is our compact Single Generator, High Pressure Hydrogen Plant. This generator produces 2500 cubic feet per hour of Hydrogen at 2500 lbs. pressure and charges cylinders direct.

TESTING EQUIPMENT — A typical installation for testing between 40 to 50 cylinders per hour in our testing department.

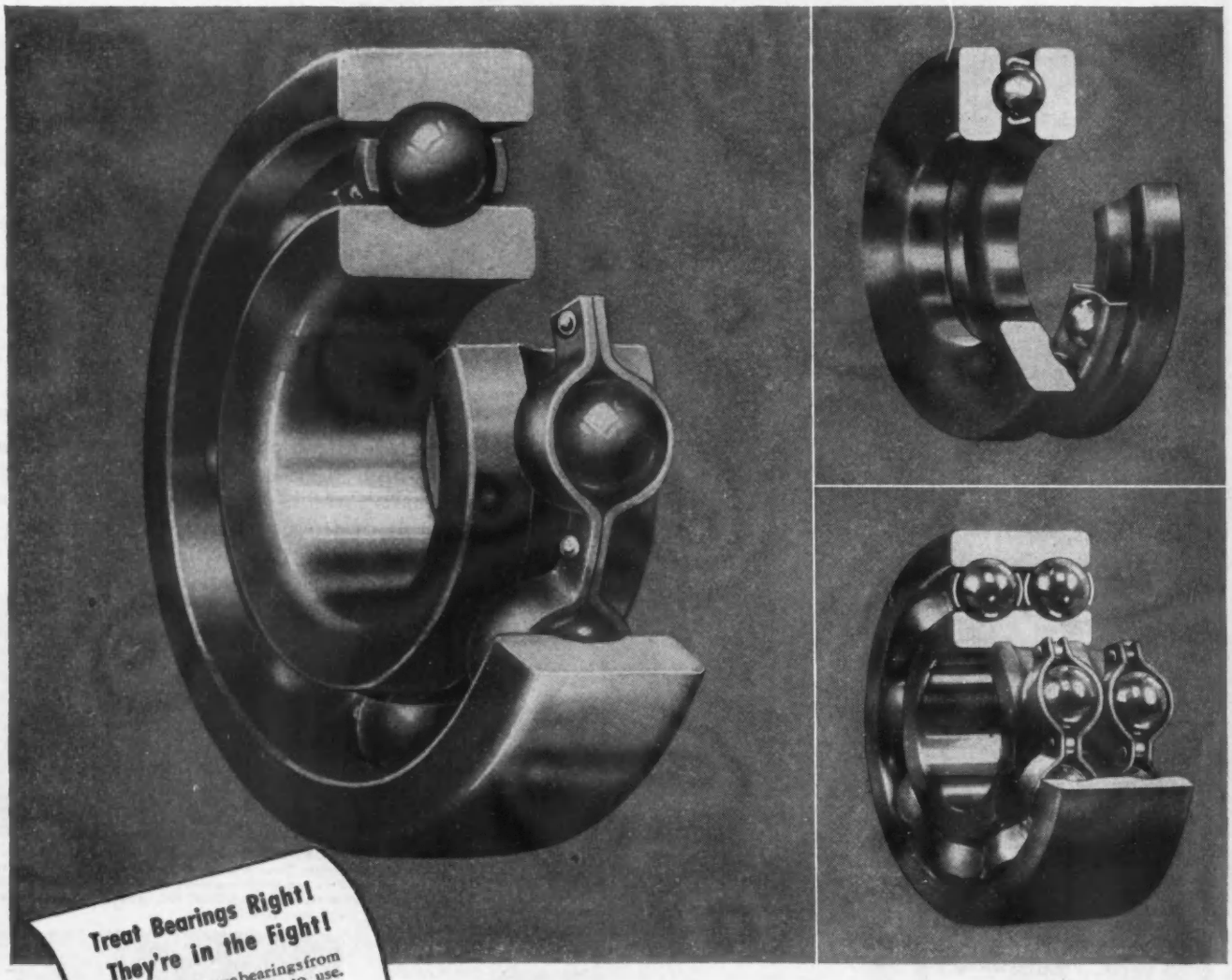
SPEED *Reconversion* WITH BCA BALL BEARINGS

WAR MAY restrict or prohibit your manufacture of machines . . . equipment . . . cars . . . trucks . . . tractors. But you can *design* improved models *now* and avoid production and sales lag in the reconversion period.

BCA Ball Bearings are *stable factors* in product design . . . because BCA builds for dependability. Considering bearing function, BCA carefully engineers for load — both amount and direction — and for type of shock condition found to exist in actual service.

Speed your reconversion by planning now to specify BCA Ball Bearings.

BEARINGS COMPANY OF AMERICA, LANCASTER, PA.



Treat Bearings Right! They're in the Fight!

1. Do not remove bearings from wrappers until ready to use. Store in a dry place.
2. Never wash new bearings. Slushing oil should not be removed.
3. When working with bearings, do not lay them down where they may come in contact with dirt. Place on a sheet of clean paper.

BCA

RADIAL • ANGULAR CONTACT • THRUST

BALL BEARINGS

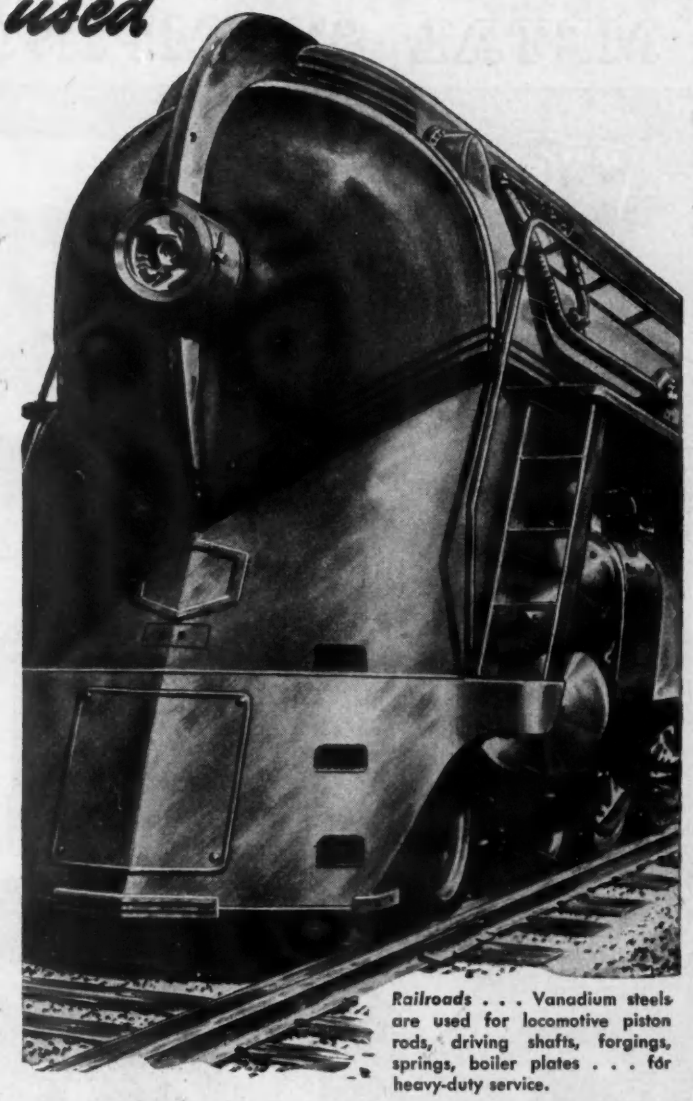
Why Vanadium is used in

ENGINEERING STEELS

Vanadium improves engineering steels by increasing their strength while maintaining their ductility. Vanadium-bearing steels are tough—resistant to abrasion, fatigue, and impact. They will deform rather than rupture under sudden overloads. This toughness is the result of a uniformly fine grain size imparted by vanadium to steel.

Vanadium steels are readily cast, forged, and rolled. They are easily machined; they have exceptional weldability. Vanadium . . . added in quantities ranging from .05 to .20 per cent, or roughly one to four pounds to a ton . . . simplifies the heat treatment of the steel. Its use results in a tough, strong, wear-resisting surface on case-carburized parts.

Besides vanadium, we produce other ferro-alloys and metals—such as chromium, silicon, manganese, tungsten, columbium, boron, calcium, and zirconium . . . used in making alloy steels. We do not make alloy steels, but we have over 37 years of experience with their development and use. If you have a problem in the selection or application of an alloy steel, call on us.

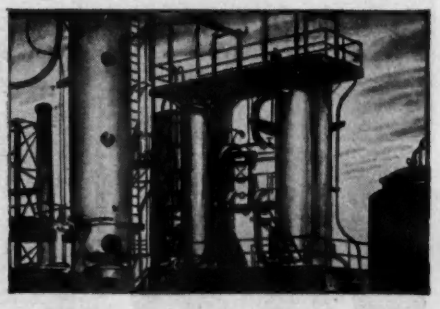


Railroads **. . . Vanadium steels are used for locomotive piston rods, driving shafts, forgings, springs, boiler plates . . . for heavy-duty service.**

BUY UNITED STATES WAR BONDS AND STAMPS

Tanks **. . . Vanadium steels are used for armament and for engine parts, such as pistons, gears, axles, connecting rods, crank shafts . . . where strength and durability are life savers.**

Mining **. . . Drill bits, digging bars, wearing plates, winch shafts, and crank shafts for pneumatic machinery, are made of vanadium steels . . . for resistance to impact and wear.**



Process Industries **. . . Vanadium steels are used for turbine shafts, internal combustion engines, pressure vessels, superheater tubes, and steam valves . . . for toughness and durability.**

ELECTRO METALLURGICAL COMPANY
Unit of Union Carbide and Carbon Corporation
30 East 42nd Street New York, N. Y.
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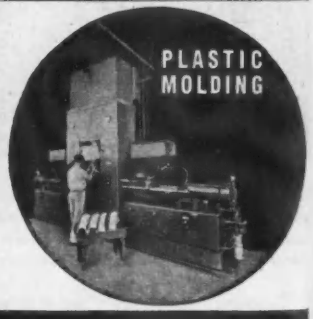
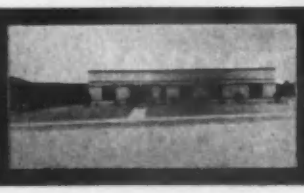
METAL STAMPINGS OF QUALITY

The Metal Specialty Co. is completely equipped to give efficient service in Stamping, Rolling, Coining, Forming and Annealing in all Metals. Specialists in Hydraulic cold drawing and embossing in all metals including Stainless Steel. Deep drawing and embossing up to 850 tons capacity. Shells drawn up to 20" depth. Assembling including Flash and Resistance Seam Welding. Pressed Metal Products to order.





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METAL SPECIALTY *Co.*
MAIN OFFICE AND PLANT • ESTE AVENUE • CINCINNATI, OHIO

Stop Any Load Quickly—Safely—Easily!

MIDLAND VACUUM POWER BRAKES

with Fully Compensating Relay Control Valve

This exclusive feature safeguards your trailer trains—permits any degree of brake application with corresponding "brake feel". Perfect synchronization between the tractor control valve and Midland's fully compensating relay valve keeps all braking in perfect time—increasing safety and ease of operation. Write for complete details, or see your distributor.

THE MIDLAND STEEL PRODUCTS CO.

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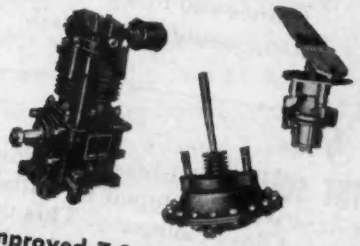
—and in AIR BRAKES Midland offers you 3 Important Advantages



1. Improved 7.3 Cu. Ft. Compressor.
2. Fully Compensating Treadle Valve.
3. Your choice of Diaphragm Chambers or Cylinders.

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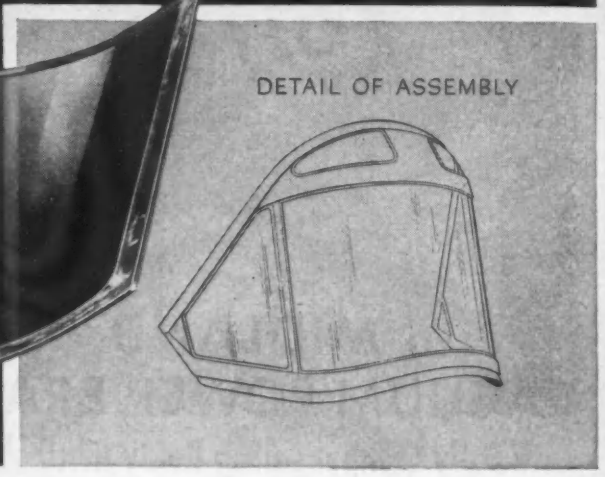
"Those Who Know POWER BRAKES • • • Choose MIDLAND!"

"PITTSBURGH" DEVELOPMENTS IN AIRPLANE GLASS

Flexible edge around vision panels



THE PROBLEM: To provide some method whereby glass breakage in vision panels, due to inaccuracies of frames and torsional stresses during flight, could be reduced.

THE SOLUTION: Flexseal Laminated Glass was developed by Pittsburgh Plate Glass Company. This notable innovation, which provides that an extension of the plastic binder be fastened into the frame, rather than the glass itself, permits the glass to "float" in the Flexseal-glazed opening while the plastic edge yields flexibly to stresses. In addition, Flexseal has greatly increased the resistance of glass vision panels to penetration.

DEVELOPMENTS such as "Flexseal" explain why Pittsburgh Plate Glass Company has become the accepted leader in the field of aviation glasses. If you would like further technical data on any aspect of safety glass for airplane glazing, write us on your business letterhead. Address Pittsburgh Plate Glass Company, 2139-4 Grant Building, Pittsburgh 19, Pennsylvania.

"PITTSBURGH" stands for Quality Glass and Paint

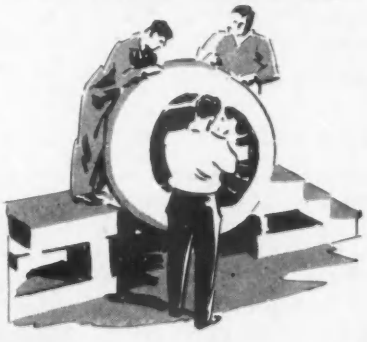
PITTSBURGH PLATE GLASS COMPANY

Specialists in Airplane Glass

MAKERS OF DUPLATE AND FLEXSEAL SAFETY GLASS AND OF MULTIPLATE BULLET-RESISTING GLASS

RUBBER BY RODIC

has hundreds of profitable uses in every industry



RUBBER BY RODIC means not merely rubber as you knew it pre-war, but also today's synthetics and plastics . . . war-developed substitutes with specific qualities better than crude rubber ever delivered. It means all three, developed to the highest degree by Rodic chemists and engineers, mass-produced by Rodic craftsmen today at the highest rate of all our 19 years in the business.

HUNDREDS OF PROFITABLE USES wherever an airtight, leak-proof, shock-proof seal is required: in motors, as cylinder seal rings, ignition wire plugs, generator oil seals . . . in ignition systems, as dielectric tubing . . . as chafing strips wherever vibration must be damped. "Profitable" today is defined in terms of saving human life, in America's planes, tanks and guns. "Profitable" tomorrow means that we can help you produce faster and cheaper and better in postwar competitive markets . . . with "Rubber by Rodic" that embraces extruded shapes, bonds, molded products, hose and lathe-cut items—each type engineered for dependable service.

IN EVERY INDUSTRY the profit possibilities of using "Rubber by Rodic" are tremendous. Not only in oil and steel and machine tools and aviation, but also in automotive, mining, machinery, textiles, and half a hundred others.

Are you ready *now* to investigate how "Rubber by Rodic" can give you an edge on postwar competition? Let us sit down with you in the planning stage. Write, wire or phone us today.

For *Sealing Unlimited . . .*

SEALING *In*
GAS, OIL, HYDRAULIC FLUID

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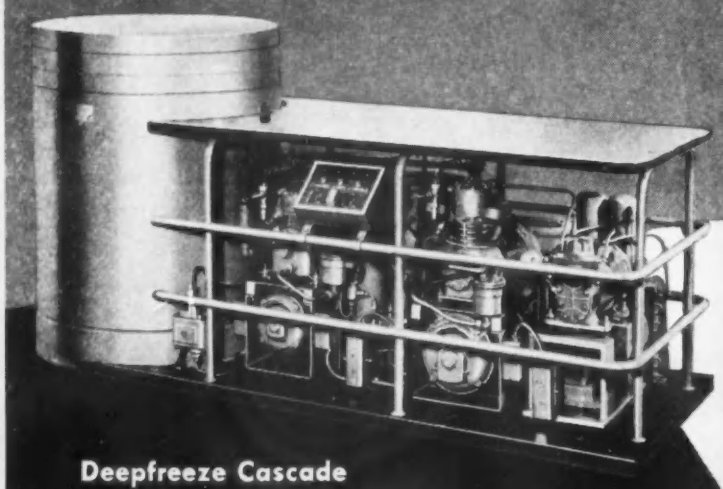
RODIC RUBBER
CORPORATION, Garwood, N. J.

Does This Answer Your Questions About The NEW Deepfreeze Process for Cold Treating Metals?



Deepfreeze Cascade
−120° F. Industrial
Chilling Machine

What Is the Deepfreeze Process?

It is the application of Deepfreeze Industrial Chilling Machines for the hardening, seasoning, shrinking and testing of metals by freezing at temperatures down to −120° F. This process involves a new principle of refrigeration, which permits faster, more efficient heat removal.

What Is the New Deepfreeze Refrigeration Principle?

100% primary freezing surface is provided in the Deepfreeze machine, which has been designed with a double-wall chilling cylinder, through which a refrigerant circulates. It is possible to reach temperatures as low as −120° F. with the Deepfreeze machine, which has the capacity to remove 1,000 B.T.U.'s per hour, at −120° F., when the work is immersed in a convection fluid.

How Does the Deepfreeze Process Compare With the Dry Ice Method?

Dry ice temperature of −109° F. delivers a maximum chill of only −91° F. working efficiency, as compared with a constant 24 hour temperature of −120° F. provided by Deepfreeze. The cost for removing 1,000 B.T.U.'s per hour for a 24-hour day, over the period of one year, with dry ice is approximately $3,000; the current consumption of the Deepfreeze machine over the same period of time costs $175.

What Is the Cost of Deepfreeze?

The initial cost of only $2,500 for the standard Cascade −120° F. Industrial Chilling Machine is quickly recovered in reduced production costs. One manufacturer saved from $3,000 to $4,000 per month in shrink-fit application. Gage manufacturers save time and money by seasoning gages to prevent change in finished size. The increased tool life resulting from cold treating reduces down-time and lowers tool cost.

Is the Deepfreeze Process Still in the Experimental Stage?

No! Hundreds of Deepfreeze Industrial Chilling Machines are now being used in actual production. Deepfreeze equipment has been tested and proven highly valuable in such firms as The General Electric Company, Timken-Detroit Axle Company, Dodge Motors, Pratt and Whitney Division, Monsanto Chemical Company, Greenfield Tap and Die Corporation.

How Are Deepfreeze Sub-Zero Temperatures Being Used?

The possibilities for applying Deepfreeze Industrial Chilling Machines in your plant are practically unlimited. Here are but a few of the many applications finding widespread use in industry today.

- Treating of high speed steel cutting tools.
- Shrinking of metal.
- Shrink-fit assembly.
- Stabilization of gages.
- Hardening of precision machine parts.
- Testing of aircraft instruments and materials.
- Testing of lubricants, paints, plastics, chemicals, synthetic rubber and pharmaceuticals.

How Can Sub-Zero Temperatures Be Adapted to My Work?

If, after checking Deepfreeze uses listed above, you are not sure how sub-zero temperatures can be beneficially applied to your manufacturing, let Deepfreeze engineers work with you in finding the solution to your industrial metal chilling problems. The Deepfreeze Industrial representative in your territory will be glad to assist you in handling sample parts for a Deepfreeze test in the factory laboratory. There is no obligation.

What About Delivery?

If you can qualify, under government priority regulations, you can expect prompt delivery on Deepfreeze standard chilling machines.

WHERE CAN I GET MORE INFORMATION?

The complete and latest data on the use of sub-zero temperatures for industrial use can be found in the new Deepfreeze Metal Chilling Data Book. A Deepfreeze representative will be glad to answer other questions you may have and can furnish you with any further information.

Deepfreeze

TRADE MARK DEEPFREEZE REGISTERED UNITED STATES PATENT OFFICE

Industrial Chilling Equipment for Shrinking, Testing, Hardening and Stabilizing Metals

2314 DAVIS STREET
NORTH CHICAGO, ILLINOIS

Division of Motor Products Corporation, Detroit, Michigan

MOORE RAPID
Lectromelt
FURNACES

LECTROMELT furnaces of the top charge type increase the tonnages of foundry steels and irons, charging quickly by crane positioned, drop bottom bucket. This advantage reduces the time between heats, minimizes the furnace heat loss, and results in lower refractory and electrode costs. Illustrated is a plant view showing recent installation of size NT Lectromelt for pouring heats of 15 to 20 tons. Size CQT 4 ton Lectromelt is shown in lower right.

Lectromelt furnaces are designed for efficient operation and are ruggedly built to give long service. The top charge type is available in standard sizes ranging from 100 tons to 250 pounds capacity.

Write for complete, detailed information.

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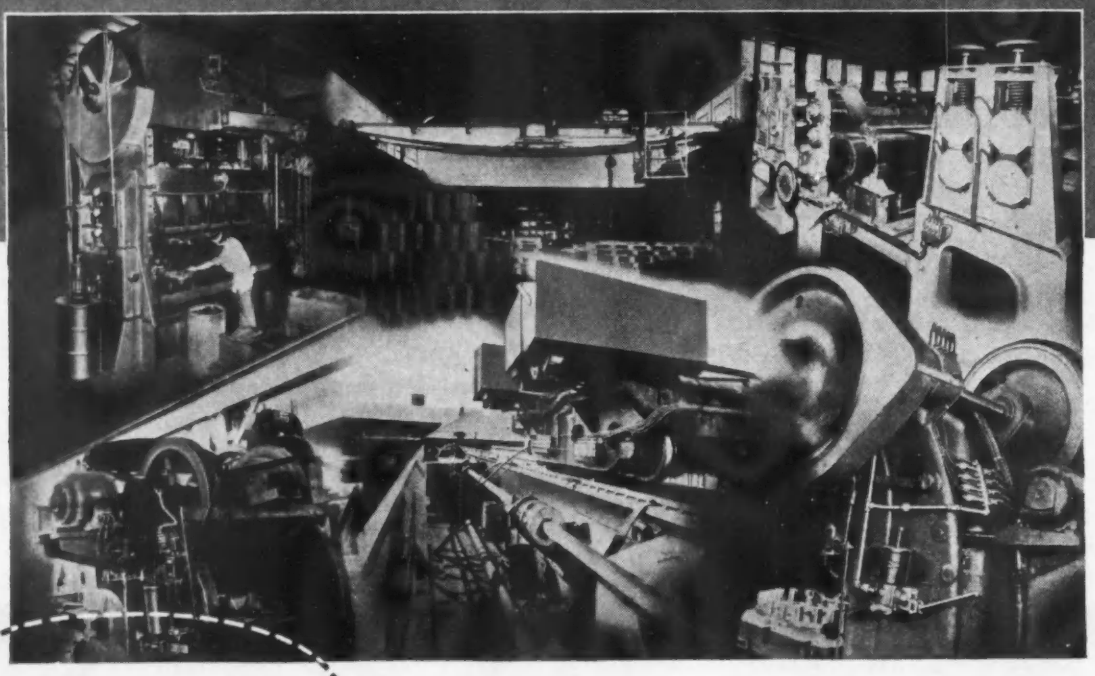
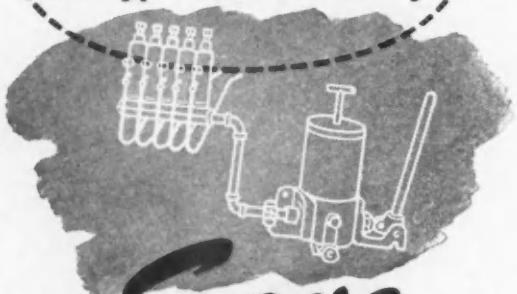
PITTSBURGH, PENNA.

LINCOLN CENTRO-MATIC LUBRICATING SYSTEMS...



THE *Modern* WAY TO LUBRICATE all types of machinery



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MAN HOURS
MACHINE HOURS
BEARINGS
POWER
and reduce accidents

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The Lincoln *modern method* of centralized lubrication, makes it possible for all bearings on one machine, or on a series of machines, to be lubricated from a central source without stopping the machines.

The Lincoln Centro-Matic System consists of a number of Centro-Matic Injectors—one for each bearing—and a hand-operated, or a power-operated Centro-Matic Lubricant Pump. The system is easy to install and will help increase your plant efficiency, not only today, but for years to come.

☆ *Special Engineering Service*

Lincoln Engineering Company maintains a staff of specialized engineers who are prepared to assist you in solving your industrial lubrication problems without obligation to you. We invite you to avail yourself of this service.

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144-7

ARMY (E) NAVY

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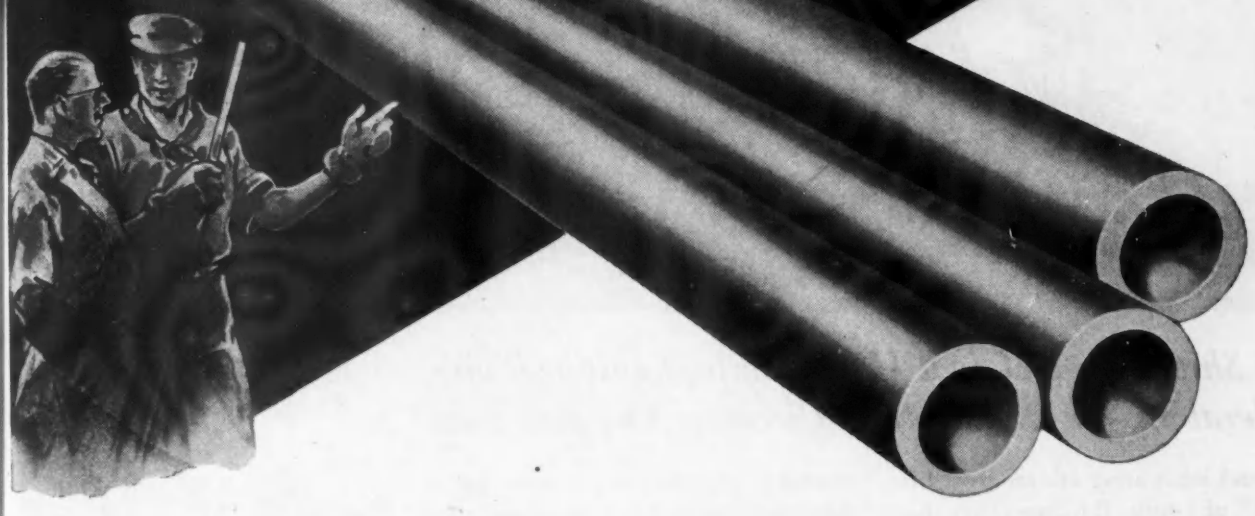
Pioneer Builders of Engineered Lubricating Equipment

5701 NATURAL BRIDGE AVE., ST. LOUIS 20, MO., U. S. A.

LINCOLN

Here's Open-Hearth Alloy Tubing That Can't Be Beat



From long mastery of the art of making *good* open-hearth steel, plus new practices and experience given impetus by war demands, Pittsburgh Steel Company has developed the production of open-hearth *alloy steel* to a degree of perfection never before obtainable. When converted into Seamless Tubing the finished product is equal in quality to comparable grades made by other processes.

Sound steel plus the alloying "know-how," and complete uniformity of analysis, heat treatment and response, gives this *Pittsburgh Alloy Tubing* a utility range limited only by imagination. Wider use in aviation, automotive, marine, processing and other applications seems a certainty.

Demonstrating the high quality obtainable with these open-hearth alloys, orders for Pittsburgh Alloy Tubing to *Magnaflux specifications* have been filled without difficulty.

Send us your "specs" for analysis and recommendation.

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Billets, Bars, Wire and Tubing

Also Carbon and Stainless Steels

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Fuel and lubricating oils are the "life blood" of a ship. It is imperative that they circulate without interruption—especially in the heat of battle. DeLaval turbine-driven IMO pumps are installed in many of our biggest ships to do the job.

DeLaval pumps are designed and built to withstand great pressure and strain. Their record for dependable operation has recommended them for unlimited service in our war against the Axis. We at Federal-Mogul are proud that DeLaval uses Federal-Mogul sleeve bearings to insure the thoroughly dependable performance essential in this service.

Bearings are vital to our war effort. Our six well-equipped plants are working 24 hours a day, turning out hundreds of thousands of bearings, bushings and similar precision parts for planes, tanks, ships, torpedoes, submarines and other military equipment.

After the war, in automobiles, refrigerators, trucks, tractors, diesel engines, pumps, compressors — remember, wherever shafts turn in sleeve bearings, for 45 years FEDERAL-MOGUL bearings have been the recognized standard of dependable quality.

FEDERAL - MOGUL CORPORATION
DETROIT 13, MICHIGAN

Bearing Specialists Since 1899

Sleeve bearings and bushings designed, developed and manufactured for engines, pumps, compressors, large machine tools and all applications where such parts are used.

Manufacturers of Equi-Poise and Tru-Pitch marine propellers from 8 inches to 12 feet diameter; Equi-Flex cushion stuffing boxes and shaft logs; struts, rudders, propeller shafts.

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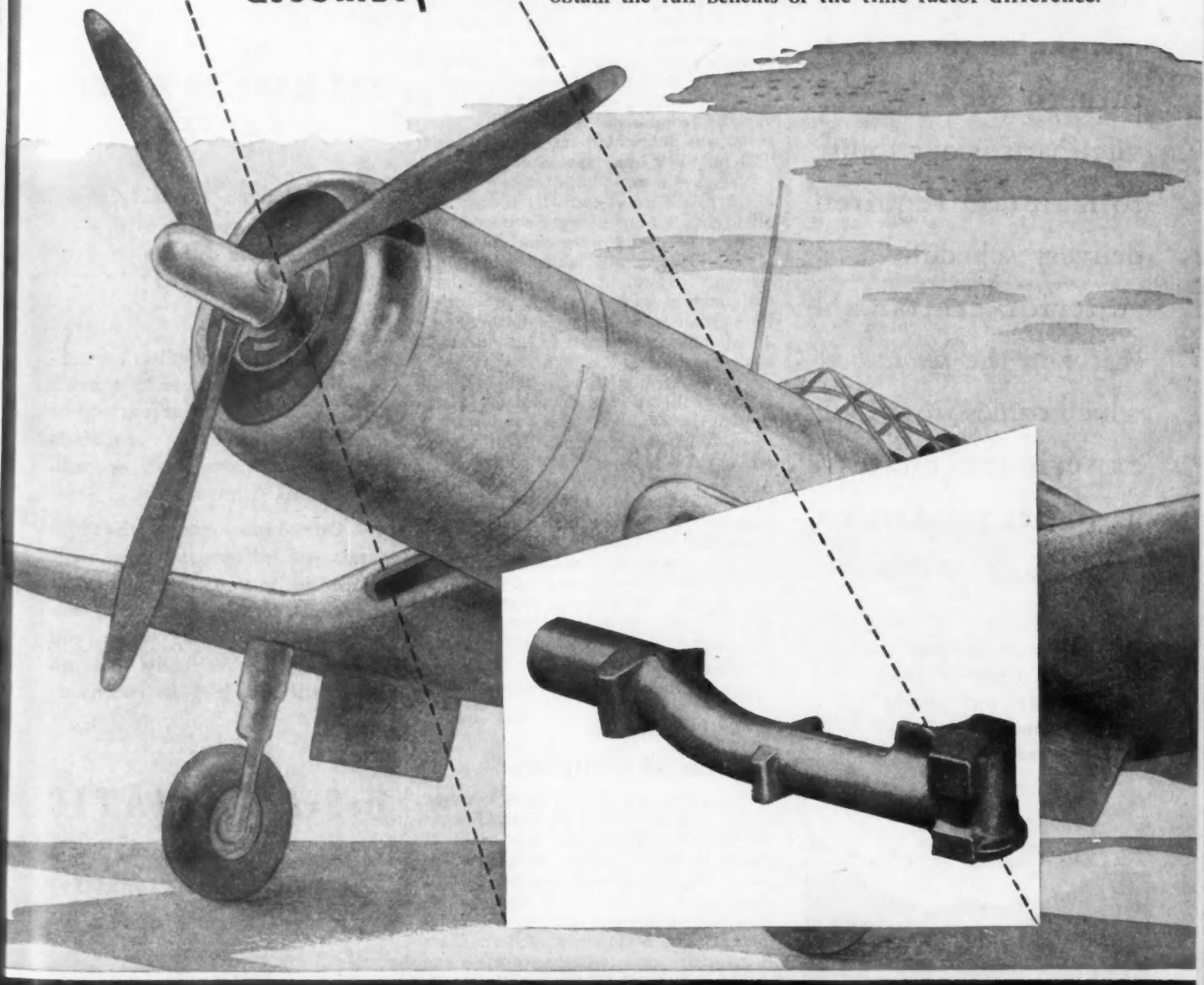
T&W FORGINGS

usually cost less at the point of assembly

There's a difference in aircraft forgings. It is convertible into a time factor. The difference originates in the forge shop. It results from how the forgings are made. Plus or minus a few minutes of time at each stage of operation in producing and finishing a forging will make an important difference in the time it takes to get the forging to the assembly line. And, since time is a cost factor, there will be some difference in the cost of the forging at the point of assembly. One difference available with T & W Forgings is the fact that they are formed to close tolerances and usually require less machining and finishing, which *makes them cost less at the point of assembly.* A T & W Forging Engineer can help you obtain the full benefits of the time factor difference.



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AT *The Cradle of Aviation*

MERCURY AIRCRAFT INC.
HAMMONDSPORT · NEW YORK

U. S. Army's Plastic Fuselage

(*Continued from page* 29)

The fuselage, side panels and tail cone were fabricated at Wright Field. Research in the fabrication of the glass-reinforced laminates and their physical properties was conducted in the laboratories of Owens - Corning Fiberglas Corp. at Newark, Ohio. Resin manufacturers who cooperated by furnishing resins for the research conducted in the Fiberglas laboratories are: American Cyanamid Co.; Marco Chemicals, Inc.; Plaskon Division, Libbey-Owens-Ford Glass Co.; Monsanto Chemical Co.; Columbia Chemical Division, Pittsburgh Plate Glass Co.; Dow Chemical Co.; and the Bakelite Corp.

The glass reinforcements employed in fabricating the laminates were heat-treated Fiberglas cloths and short, fine fibers known as Fiberglas flock. The resins were Plaskon 900, Laminac P-4122, MR-1A, Monsanto 38691, CR-39, CR-39Bd, and CR-149. Each of various combinations of glass and resin was fabricated into 0.25 in. and 0.50 in. thick laminated sheets.

The sheets were cured at a pressure of 15 psi in an electrically heated hot air oven. Specimens were cut from the cured sheets and were machined and tested. Test results indicate that on a strength to weight ratio, glass cloth laminates possess physical properties comparable to those of a number of the metal alloys now used for aircraft structural parts.

Tensile strengths were found to be proportional to the amount of glass present in the laminates, and varied from 43,360 to 54,720 psi. Compression strengths as high as 56,820 psi were obtained. Flexural values ranged between 45,350 and 84,600 psi. Impact strengths of unnotched specimens were from 28.82 to 31.25 foot-pounds. Modulus of elasticity was 2,200,000 psi. Average specific gravity was 1.75. These values are for cross-laminated glass cloth. Strength values approximately twice as high may be obtained with parallel-laminated cloth.

New Home for McDonald Company

Occupying an entire block between 51st and 52nd Streets on South Hoover St. in Los Angeles, the new plant of the B. F. McDonald Company provides nearly thirty thousand square feet of floor space for the firm's manufacturing, assembling and executive departments. The building, a modern Class A structure, was recently acquired, and permits the company to consolidate its assembly and production facilities under one roof. The McDonald Company is well known in the safety industry, having introduced a number of specialized safety devices.

POST WAR STRATEGY

GET MORE TO MARKET *FASTER*

Concentrate on assembly and---

Leave the parts details up to (US)

Supplying speeding assembly lines on schedule is a habit with us. If our great variety of standard automatic machines won't make parts fast enough, we invent time-savers.

Our experience with thousands of different jobs will enable us to cut corners for you in the competitive post-war markets. Remember when you are ready, we're ready too-- no time will be lost in reconversion.

U•S•AUTOMATIC
CORPORATION
Screw Machine Products
AMHERST • OHIO

U.S. AUTOMATIC

When you design for Comfort
DON'T FORGET THE EYES

Avoid Fatigue...Help Vision

with L·O·F POLISHED PLATE GLASS

HI-TEST L·O·F SAFETY PLATE

If glass were something a driver used once in a while, it might not be so important...

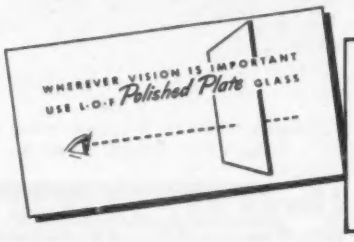
But *every* minute on the road he's peering through glass. And excessive eye fatigue is a natural result if his eyes must compensate constantly for optical distortions. Even minor distortions not apparent in a casual glance can cause eye fatigue when looked through for long periods of time at a roadway that never stands still.

There is a way to avoid this—and thus make an important contribution to highway safety. Provide clearer vision with Polished Plate Glass—not only in windshields, but in side and rear windows as well.

For greater clarity of image use Libbey·Owens·Ford Clear Vision Hi-Test Safety Plate Glass. Its two lights, held together by a clear, tough plastic interlayer, are ground like an eyeglass and polished like an expensive jewel.

For today's replacement jobs—and for tomorrow's new designs specify L·O·F Hi-Test Safety Plate Glass. Libbey·Owens·Ford Glass Company, 4054 Nicholas Building, Toledo 3, O.

Good driving requires good visibility. Good visibility calls for good glass. Provide it with L·O·F Polished Plate Glass.



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Adeco offers you a dependable source of supply with the know-how, experience and complete facilities for all types of close-tolerance production. It will pay you to include Adeco fabrication in your post-war plans.

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CHICAGO 40, ILLINOIS

"Your Partners in Production"

Contour Forming of Extrusions

(*Continued from page* 25)

the flange angle by stretching. It is best to incorporate any flange angle variation in the straight preformed section, as shown in Fig. 11.

Channels and hat sections formed with the flanges up must be recessed in the form block and a filler block placed inside to keep the flanges from bowing. The part must fit the form block with about 0.015 in. clearance, while the filler block should be made to fit inside the part within 0.005 in. to 0.010 in. These are very close fits, but the greater the clearance allowed the more the sides will bow (Fig. 12). The 1/32 in. should still be allowed in depth for the hat section flange so that lateral shrinkage will not distort the flange angle. Preformed "V" sections make ideal stretch parts, for they form nicely and the part and form block may be made to size according to the blueprint (see Fig. 13).

Cap strips, as used on the trailing edge of the empennage and wing tips, are very economical stretch form jobs. They may be stretched to contour from flat material sheared to finished width. A radius is first formed into the strip along the full length on its center line, the size of the radius being dependent upon the cross section of the part, as illustrated in Fig. 14.

The tooling for stretch form blocks is comparatively inexpensive in relation to the difficult contours possible to stretch form. For high production of parts, it is essential to have efficient self-energizing or power operated clamps. The clamp grippers must be made to mate with the cross sectional shape of the preformed section and should have a rough clamping surface to increase friction. A 60 deg knurl of 16 to 32 pitch has proven to be very effective and economical to machine. All sharp corners must be ground into a smooth radius, as any sharp edges will cause part breakage. In designing the grippers, care should be taken to space the section so the centroid of the part will be on the center line of the hinge point of the clamps, Fig. 15; otherwise they will tend to rotate due to the lever arm between the two center lines, and part breakage may result.

Stretch form blocks may be made of masonite, hardwood, kirksite, and other materials. Masonite has proved to be very adaptable, being a hard material which is easy to work.

War Bonds
are
A Good Buy

THE CECOSTAMP SOLVES NEW METAL FORMING PROBLEMS

THE Cecostamp was designed by Chambersburg to meet and solve these problems: Forming tougher, more elastic alloy sheets in clear-cut die impressions without tearing, wrinkling or reduction of section, to accurate limits without mismatching, and speeding the production of such parts. How well it has done so is indicated by the fact that practically every aircraft manufacturer in the United States, and many of the most important ones in the countries of our Allies, are using Cecostamps.

Chambersburg Engineering Co.
Chambersburg, Penna.

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Illustration is from Inland Poster showing an operation in the production of Inland-made Spark Plug Terminal Seal

Inland's broad experience in the compounding of synthetic and natural rubber for hundreds of peacetime and war products enabled us to formulate a special synthetic rubber compound for the Spark Plug Terminal Seal. This Seal, a tiny part weighing only 11/20,000 of a pound, helps keep aircraft ignition systems performing satisfactorily in the rarified stratosphere.

Today, the Terminal Seal is one of many parts by Inland helping American bombing and fighter planes complete their missions at higher and safer altitudes.

INLAND MANUFACTURING DIVISION
General Motors Corporation, Dayton, Ohio

Inland Products for Victory include Carbines, Tank Tracks, Gun Sights, Helmet Liners, Extinguisher Horns, and Rubber and Metal Parts for Tanks, Aircraft, Submarine Chasers, Torpedo Boats, Artillery Lighters and Landing Craft.

INLAND

INLAND *Manufacturing*

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light **TO DRIVE BY**
light **TO FLY BY**

DEPENDABILITY is the outstanding characteristic of TUNG-SOL Lamps. It caused their adoption by the automotive industry for initial equipment and replacement over a quarter century ago. It has caused their adoption by the aviation industry. Today you find TUNG-SOL Lamps in service in all types of ground vehicles and aircraft throughout the world. Specify TUNG-SOL when ordering lamps.

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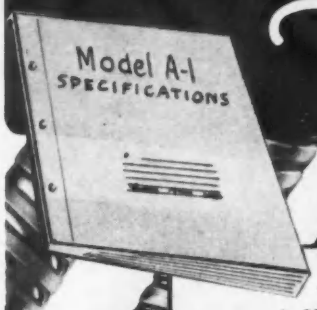
ARMY E NAVY

TUNG-SOL LAMP WORKS INC., NEWARK 4, N. J., Sales Offices: ATLANTA, CHICAGO, DALLAS, DENVER, DETROIT, LOS ANGELES, NEW YORK, PHILADELPHIA. ALSO MANUFACTURERS OF ELECTRONIC TUBES AND CURRENT INTERMITTORS

WHEN "SPECS" CALL FOR THE BEST IT'S WALKER-TURNER *Flexible* SHAFTING



★ Walker-Turner Flexible Shafting is not a "war baby". For many years this Company has been one of the largest manufacturers of flexible shaft machines for industry Constantly improving the design of our machines, we have brought the shafting to a high state of development. Recognizing our wide experience in this field, other manufacturers of mechanical products constantly consult us. As a result, we have assisted in designing this form of power transmission and remote control in many applications outside the machine tool field, especially today in mechanical weapons of war.

If you have a problem in remote control or power transmission, get in touch with us.

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Plainfield, N. J.

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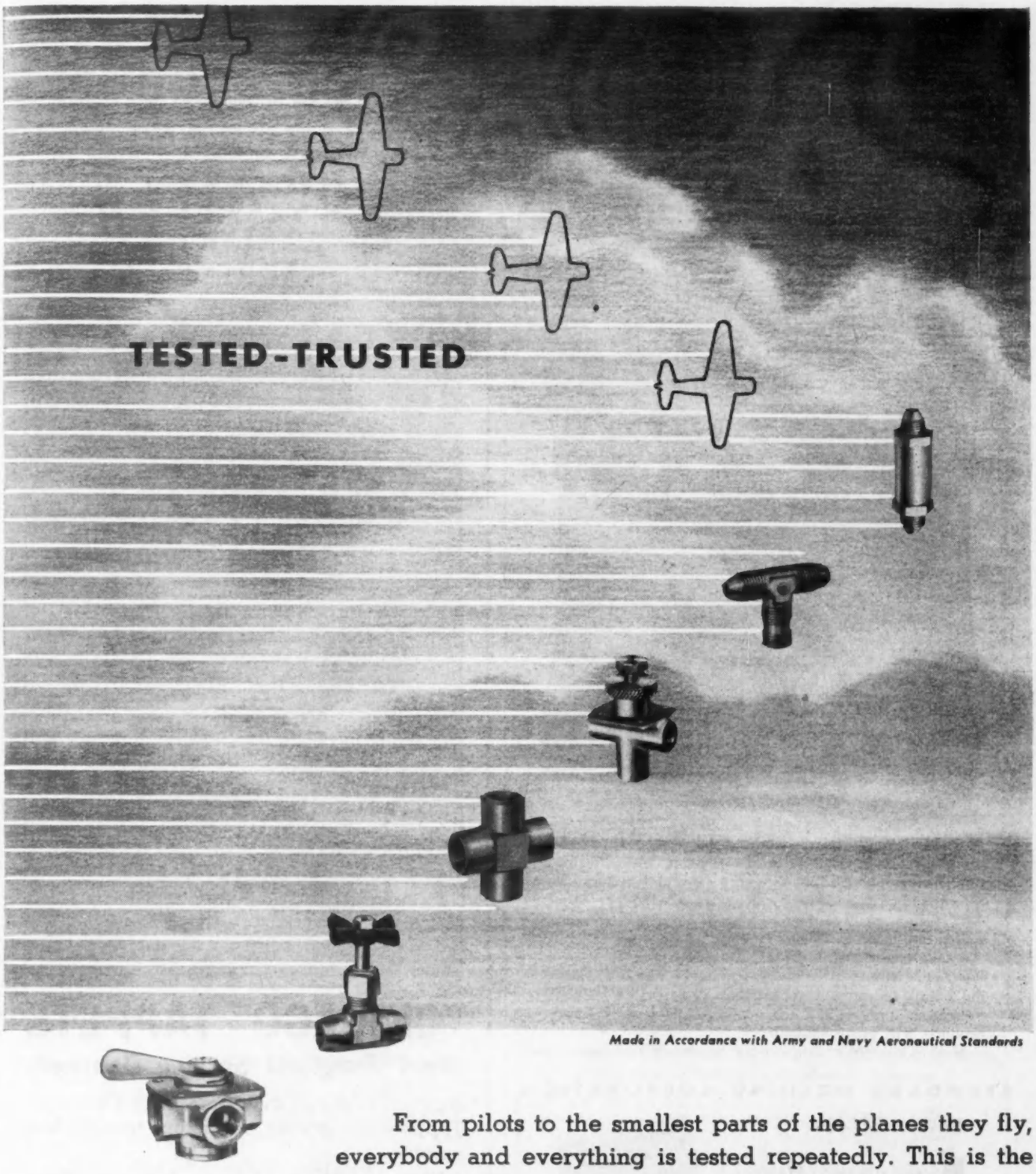
FLEXIBLE SHAFTING

FOR REMOTE CONTROL AND POWER TRANSMISSION



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From pilots to the smallest parts of the planes they fly, everybody and everything is tested repeatedly. This is the basis for confidence and the fact that our Air Forces can be trusted to give such a good account of themselves.

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How Many PLASTIC PARTS *Like This Do* YOU *Need?*

The above photo illustrates only a few of the many plastic parts injection molded daily in our plant. Unfortunately, this photograph does not show the many different specifications and close tolerances which were adhered to. Neither does it show many of the tough problems encountered and solved due to Standard Engineering "know how."

Standard Molding Engineers have been associated with injection molding since the inception of this division of the plastic industry. Their advice and assistance on your present engineering and production problems and postwar products will prove valuable.

Mail us your blue prints today for detailed analysis.

STANDARD MOLDING CORPORATION

Dayton 1, Ohio

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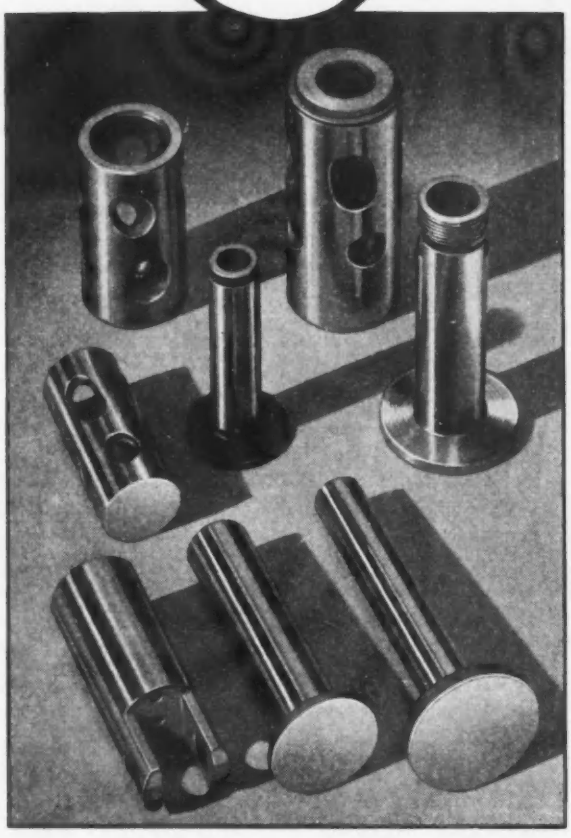
CHICAGO AIRCRAFT QUALITY VALVE TAPPETS



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Meet Toughest Service Demands

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We specialize in the manufacture of Steel and Cast Iron Mushroom, Steel Roller Type and the patented Chicago Ported Type and Cast Iron Barrel Type Tappet.

Our facilities are complete in every detail to produce a Quality Product in any quantity.

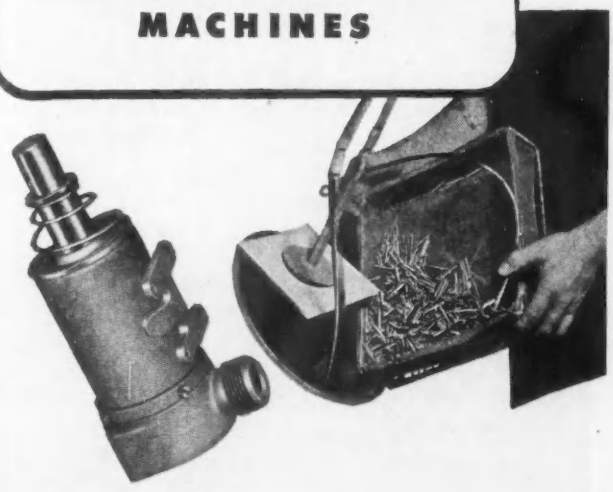
ARMY E NAVY

THE CHICAGO SCREW CO.

ESTABLISHED 1872

1026 SO. HOMAN AVENUE CHICAGO, ILL.

SCREENING MEN MATERIALS AND MACHINES



Cannon Quality Control operates to eliminate failure wherever it may be found. It is a continuous "screening" process that grades out materials that no not measure up to critical standards—that scraps mal-functioning tools, jigs, machines and equipment—that shifts men and women to the jobs they are best suited to handle.

It's relentless in the way it operates but it results in a product that we are glad to trade-mark and on which you can depend. Cannon plugs are good plugs because all the elements that go into them —men, materials and machines—are good.

VISUAL AIDS FOLDER

The many visual training aids offered by Cannon Electric include wall charts, training films and engineering bulletins. These are listed and described in a new four page folder, available on request. Address Dept. A-109, Cannon Electric Development Co., 3209 Humboldt Street, Los Angeles 31, California.

CANNON ELECTRIC

Cannon Electric Development Co.
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Representatives in principa lcities—Consult your local phone book

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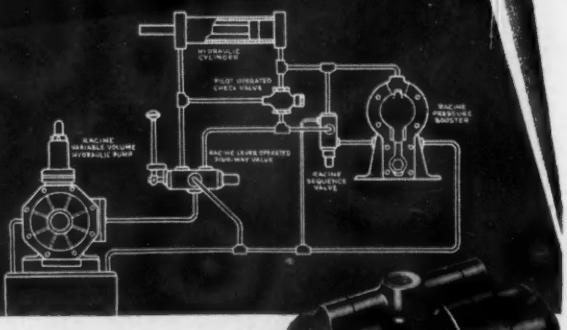
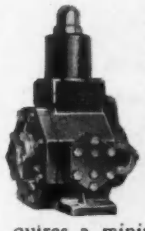
RACINE PRESSURE BOOSTER . . .



- ★ *Replaces High Pressure Pump*
- ★ *Permits Use of Your Present Pump and Motor*
- ★ *Cuts Operating Costs*
- ★ *Compact, Simple, Leak-Proof Construction*



A Racine Hydraulic Pressure Booster will give your oil hydraulic circuits greater flexibility. *Now you can get 50 to 3000 pounds pressure* from your present low pressure constant or variable volume hydraulic pump. Use lower horsepower motor and low pressure control valves.

Exclusive and patented by Racine, this Hydraulic Pressure Booster is free from repairs —no driving mechanism to wear out. Requires a minimum of space. Booster is 10⅛" high, 8⅛" wide, 18" long.

Racine Offers a Complete Hydraulic Service

Include in your hydraulic circuits Racine Oil Hydraulic "Vane Type—Variable Volume" Pumps. Capacities 12-20-30 G. P. M. Operating pressures 50 to 1000 lbs. P. S. I. Also Racine "Sleeve Type—Balanced Piston" Valves. Sizes ⅜ "to 1½". Racine hydraulic engineers will be glad to help you with your hydraulic applications. Write for complete Catalog No. P-10-C. Address Dept. AA-P.

RACINE HYDRAULIC METAL CUTTING MACHINES
The Production Saws of Modern Industry

A full line of Metal Saws including models with Racine Automatic Stock Feed. Racine Saws feature the latest improvements and devices for accurate, high speed cutting of all metals. Blade life is increased because of Racine's Hydraulic Control of feed and pressure. They can be regulated to cut any metal at the right speed regardless of density, shape or structure.

For a metal saw of modern design and high efficiency — one that will pay for itself by the savings it makes, a Racine is your best bet. Available are a wide variety of models in all price ranges. Capacities 6" x 6" to 20" x 20". Write for Catalog No. 12. No obligation.

RACINE
TOOL AND MACHINE COMPANY
Standard for Quality and Precision
RACINE, WISCONSIN U. S. A.

for
HEAT-TREATING
Write "Ritco"

RITCO's modern carburizing and heat-treating department includes Leeds and Northrup equipment and A. F. Holden Electric Furnaces. Our personnel also is well qualified to do your work. Send us complete specifications or samples for estimates. Catalog on request.

SPECIAL BOLTS, NUTS AND STUDS
DROP FORGING & DIE SINKING
SCREW MACHINE PRODUCTS
HEAT TREATING
SPRAYED METAL SERVICE
PARKERIZING

We will gladly quote on your specifications.
Catalog on Request

RITCO

RHODE ISLAND TOOL COMPANY

148 West River St., Providence 1, Rhode Island

Serving American Industry Since 1834

Chosen for these Qualities

RUGGEDNESS—The unbreakable construction of forging top plate and king bolt from a single piece of SAE-1045 carbon steel . . . yoke base forged of SAE-1045 . . . structural steel legs.

BIG CAPACITY—Tough enough to handle 16,000 lbs. per set of four—2 tons per caster!

EASY HANDLING—Double ball race swivel in machined raceways with 230 (or 500) Brinell hardness. Hyatt or Timken roller bearings.

TOUGH WHEELS—Standard wheels 8" to 12" diameter; dual wheels if desired. Cast steel, certified malleable iron or moulded plastic.

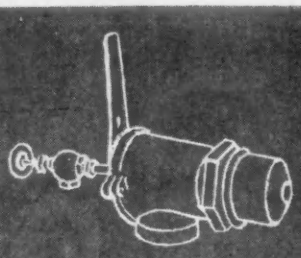
SERVICE CASTER & TRUCK DIVISION
OF DOMESTIC INDUSTRIES, INC.
675 N. Brownswood Ave., Albion, Mich.
Eastern Factory: 420-26 Somerville Ave., Somerville (Boston) Mass.
Toronto, Canada: United Steel Corporation, Ltd., SCAT Co. Division

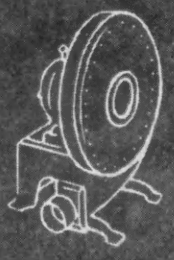
SERVICE

Trucks, Casters and Specially Designed Lifting and Hauling Units

Take your Non-Ferrous Melting Problems to

FISHER

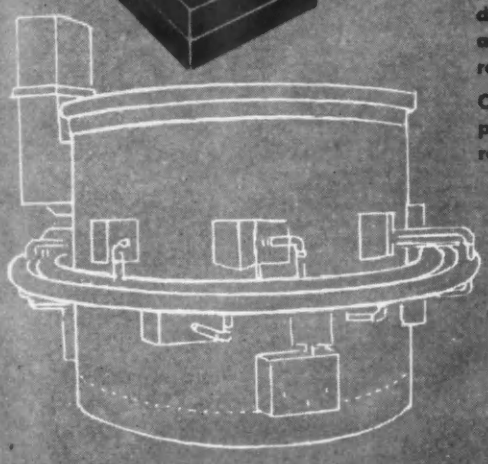


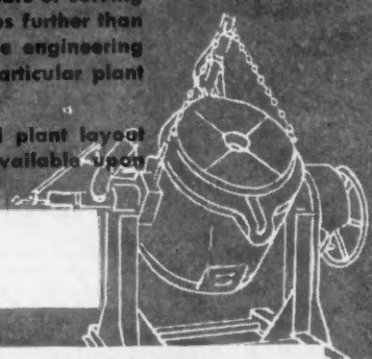


—and receive values beyond ordinary specifications.

Fisher Furnaces, Blowers and Accessories are the result of development and progress through years of solving production problems. Fisher Service goes further than design and construction. It includes the engineering application of the equipment to your particular plant requirements.

Consult Fisher on your equipment and plant layout problems. Bulletins and catalog are available upon request.





New Bulletins:
Fisher Furnaces
Fisher Accessories Catalog
Write for your copies

5525 North Wolcott Ave., Chicago 40, Illinois

Fisher FURNACE COMPANY

Engineers and Manufacturers

New Speed

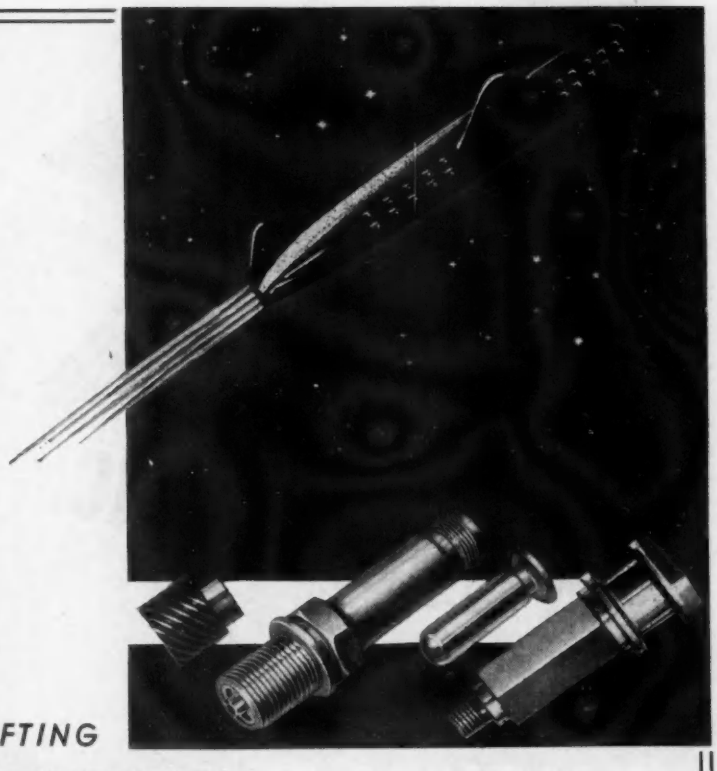
in Flying and Fabricating with B&L

ULTRA-CUT STEEL

Like the *rocket jet plane* in combat, Ultra-Cut Screw Stock in production is setting new records in performance.

This free-machining high-sulphur Bessemer grade is the *ideal screw steel* for high-speed automatics. It meets the requirements of that great variety of *run-of-the-mine* machine parts used in airplanes, automotive equipment and industrial machinery.

Specify Ultra-Cut Cold Finished Bar Steels for fabricating intricate machine parts where quality, accuracy and fine finish must be combined.



COLD FINISHED STEEL AND SHAFTING

BLISS & LAUGHLIN, INC.

HARVEY, ILL. Sales Offices in All Principal Cities BUFFALO, N. Y.

Write for the new B & L Production and Estimating Calculator, handy for machine operators. Sent on request.

GRAND Speed CLAMPS

The Most Complete and Up-to-the-Minute Line of Modern Time-Saving Clamps

Quikcet

Dual Grip

Ground Clamp

Alloy-Steel

Heavy Duty Speed

Quick Lockcet

Screws, Swivels and Handles COPPER PLATED against Welding Spatter

QUIKCET for fast (4-second) Clamping—Instant ratchet set and release, fulcrum screw tightening, 1-hand operation and a non-creeping grip even on irregular surfaces. Setting the pace in war production.

DUAL GRIP — Double action malleable clamps. Side tightening for close working conditions. No twisting or creeping.

WELDERS' GROUND CLAMP. Completely copper plated, with connection for ground wire.

ALLOY-STEEL Medium and heavy service "C" Clamps of even greater than forged clamp capacity. Also a complete line of Malleable "C" Clamps.

HEAVY DUTY SPEED CLAMPS. 2-handed, lever locking and instant release. Also Giant 10½" opening size.

QUICK LOCKCET—For light fast work. Locking lever gib seat and instant trigger release.

Our new 32-page catalog illustrates and describes these production clamps in detail. A copy is yours for the asking. Write today.

GRAND SPECIALTIES CO.
3113 WEST GRAND AVE. CHICAGO 22, ILL.

SpeedWay

After The Others Failed

SpeedWay's "know how" was able to develop new gearmotor designs for the Armed Forces that did the required job. Today, expanded needs for these motors take SpeedWay's capacity, as well as the capacities of other large motor manufacturers, *working to SpeedWay Specifications.*

If you need motors or gearmotors for a standard or special application, bring your problem to SpeedWay Motor outputs range from 1/3000 to 1/3 h.p. Unlimited gear ratios available from stock gears. Write for our recommendations on your war or postwar problem.

Write for SpeedWay's new Motor Bulletin showing standard A.C., D.C., and Universal Motors and gearmotors.

SPEEDWAY MFG. CO. 1872 S. 52nd Ave., Cicero 50, Ill.

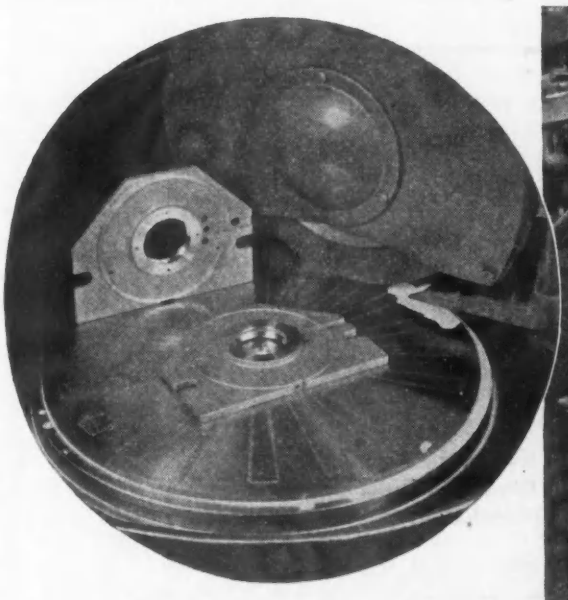
LIFT TRUCKS, INC.

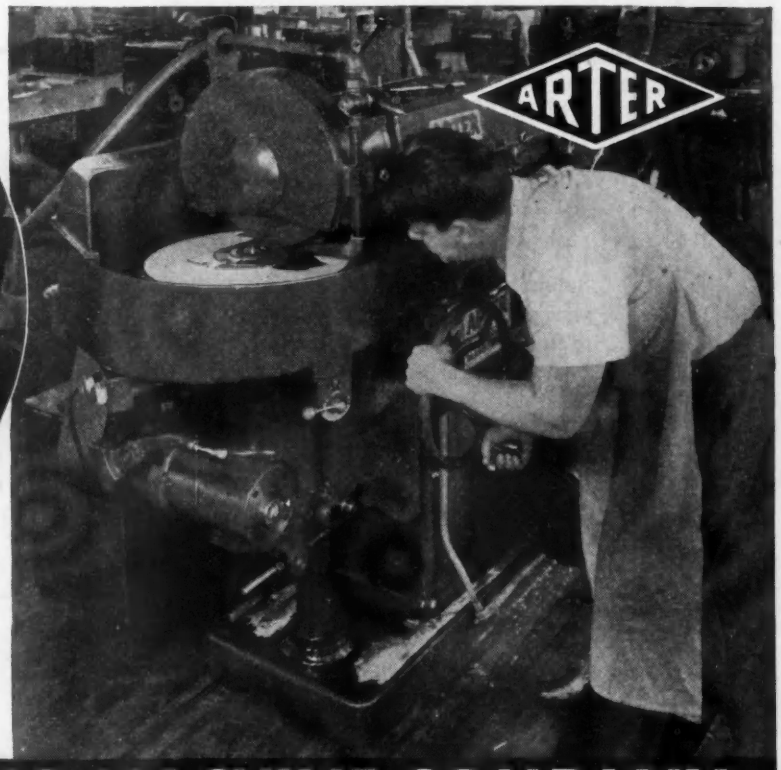
Proved before and during war—ready, now, for application to any "under-roof" load lifting and moving requirements. Illustrated is the HYDRO-LECTRIC Motorized hand lift truck *—weighing only one-third, costing only one-third as much as other "rider" types of electric trucks.* The Hydrolectric is the engineering creation of Walter C. Stuebing, pioneer in lift truck engineering and manufacturing. Send today for file-size catalogue of the Hydrolectric and other standard type lift trucks.

2425 SPRING GROVE AVENUE
CINCINNATI 14, OHIO

Within the boundaries of these two forces lies the great majority of spring usage. By what method these varying forces are applied depends on individual requirements of space and performance. Size or shape of the spring is not an indication. Large springs may be made to transmit a flicker of impulse—small springs can bear the shock of heavy loads. There are many ways to exert identical spring force—there is only **one** way to apply it to your requirements. To get correct spring results is the work of scientific engineering methods. You find these methods in constant use at Gibson's.

WILLIAM D. GIBSON CO.
DIVISION OF ASSOCIATED SPRING CORPORATION
1800 Clybourn Avenue, Chicago, Illinois





For general tool room grinding. Model A-3 Rotary Surface Grinder at Vinco Corporation, Detroit. Simple to operate . . . produces good finish . . . holds work to close tolerances. Production increase—50 to 100 per cent.

ARTER GRINDING MACHINE COMPANY
ARMY E NAVY
WORCESTER, MASSACHUSETTS • U. S. A.

AVOID USELESS EXTRA WRAPPINGS!

Paper is Precious

WRAPPING, like a lot of other business practices, is desirable, and useful. But in times likes these, when every single piece of paper is a precious piece of war material, wrappings should be mighty carefully examined in terms of their ultimate importance.

A paper wrapping around a boxed product is truly a waste of paper these days. Such wastes mount into big national figures.

So why not check your wrapping policies? Look into the whole procedure to see how you can cut down on the use of paper; yes, and on the use of equally precious paper board.

Only if every merchant makes a serious study of his store's paper use and practices the most rigid economy, can we hope to help the War Production Board put over its great coast-to-coast paper conservation drive and supply the paper and the paper board our invasion forces need.

If you have no Paper Conservation Committee in your community, why not get one started now?

USE LESS PAPER BECAUSE

Multiwall paper bags are used extensively in shipping flour and dehydrated foods. All openings and exposed surfaces of tanks are sealed with paper for shipping.

Submachine guns are not only paper-wrapped but boxed in paper board. Shell grommets, bomb rings and practice bomb fins are made of paper to save needed steel.

Gas-mask canisters and hand-grenade containers are made of paper.

Paper is used in camouflage strips and netting and parachutes.

USE LESS PAPER THESE WAYS

Eliminate fancy wrappings. Special gift wrappings, holiday wrappings should be used only if they replace and do not supplement regular wrappings. Such wrappings should be saved for re-use next year.

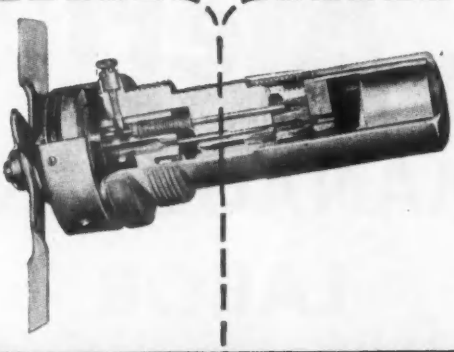
In the large stores and in the chains and groups of stores, management should enlist wrappers in the campaign, urging them to experiment with wrapping tricks which will save paper.

The sole test of the essentiality of any wrapping to any retail operation should be: "Is it needed to protect the merchandise?"

This advertisement prepared under the auspices of the War Advertising Council in co-operation with the Office of War Information and the War Production Board.

LET'S ALL USE LESS PAPER

Can your parts or product use this WARTIME PRECISION?



"PACKAGED METAL ENGINEERING*"

- ✓ CUTS PRODUCTION AND ASSEMBLY COSTS ON PARTS AND PRODUCTS
- ✓ SAVES MATERIALS AND WEIGHT
- ✓ IMPROVES UTILITY AND APPEARANCE

Here is wartime precision ingenuity and assembly skill for your peacetime product or parts—intricate 100% precision assembly job with more than 60 extremely close tolerance gaging inspections.

Grammes can be your *complete* manufacturing source, providing the all-inclusive services and facilities of "Packaged Metal Engineering"—**in one package . . . one service . . . we take over ALL responsibility, acting as YOUR factory, from Design Research to Drop Shipments.*

With 69 years of precision fabricating skills, cleverly devised assembly methods, and broad "know-how," Grammes can save you time, money and materials on your parts or product. The facilities listed provide a *centralized* set-up for efficient and economical precision fabricating and assembling.

STAMPING · ETCHING · LINE ASSEMBLY · DRILLING
DRAWING · TOOLS & DIES · MACHINING · WELDING
SPINNING · EMBOSSING · SPRAYING · PLATING
WIRE FORMING · LITHOGRAPHING · HARD ENAMELING
SCREW MACHINES · HEAT TREATING

From idea development and product improvement to post-war manufacture, Grammes Contract Service facilities are available NOW for Research, Design, and Engineering. Let us work with you, complete confidence assured. Send today for our booklet—"Contract Service by Grammes"—address Dept. 11-5.

"MASTER CRAFTSMEN IN METAL"

Grammes

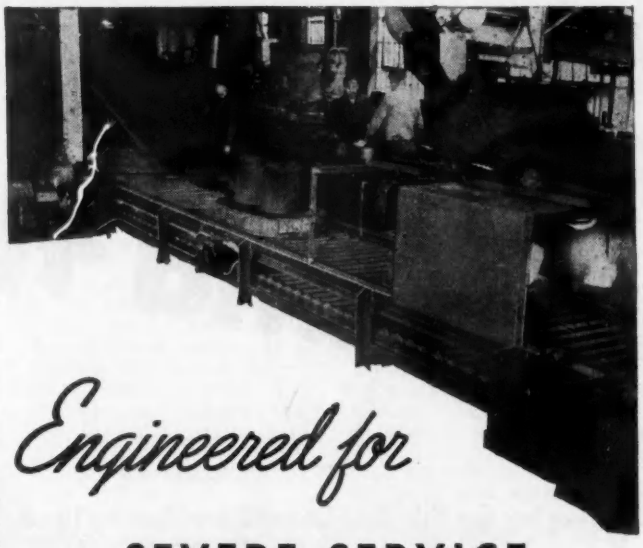
L. F. GRAMMES & SONS, INC., ALLENTOWN, PA.

ESTABLISHED 1875

NEW YORK · CHICAGO · DETROIT · CLEVELAND · MILWAUKEE · PHILADELPHIA

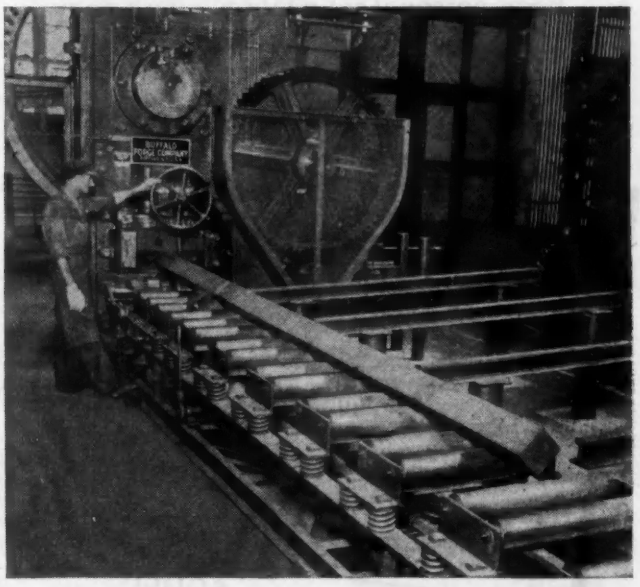
Oldsmobile · CHEVROLET · Mack

ALSO CREATORS OF DECORATED NAME PLATES • TRIMS • BEZELS • ESCUTCHEONS



Engineered for SEVERE SERVICE

Mathews Conveyers, like all production machinery, have taken a great amount of punishment as America's tremendous industrial effort grew and expanded. In foundries, steel mills, brass and aluminum plants, and our great arsenals, they have been on the job, taking the pounding of greater and greater production of essential materials. These conveyers are still taking it because they were built for severe service. Long experience in working with the heavy industries has taught Mathews Engineers to figure rugged equipment for heavy work. Your Engineer can show you why Mathews Conveyers can serve so long on the most severe conveying job. This service is available in principal cities in the United States and Canada.



Mathews Conveyer Company

ELLWOOD CITY, PENNSYLVANIA

Sound the Alert!

MANAGEMENT
LABOR

—for the 5th War Loan drive during June and July. The need for the 5th War Loan is immediate, crucial. For impending events may make the 5th the supreme financial effort of the war.

The U. S. Treasury has set the overall goal at $16,000,000,000 — $6,000,000,000 from individuals alone. This is the biggest sum ever asked of the American people—*and it must be raised.*

That's why the U. S. Treasury asks Management and Labor to sit down together and organize—NOW!

For organization—good organization—has been responsible for the excellent showing of the payroll market. And its most important single superiority has been personal solicitation—desk to desk, bench to bench, machine to machine personal solicitation. 71% of all persons on payroll deductions were solicited for the 4th War Loan.

Now, to personal solicitation, add the sales incentive of a definitely established plant quota. Build your campaign around a quota plan. Set up departmental goals. Stress percentage of participation figures. Stimulate group enthusiasm.

In planning your quota campaign, work in close cooperation with the Chairman of your War Finance Committee. Everything is set to make the 5th War Loan drive a huge success—with your help!

(Note: You've read this message. If it doesn't apply to you please see that it reaches the *one* person who can put it in action!)

Here's the Quota Plan:

1. Plant quotas are to be established on the basis of an *average* $100 *cash* (not maturity value) purchase per employee.
2. Regular Payroll Savings deductions made during the drive accounting period will be credited toward the plant quota.
3. 90% of the employees are expected to contribute toward raising the cash quota by buying extra 5th War Loan Bonds: 1—Outright by cash. 2—By extra installment deductions. 3—By extra installment deductions plus cash.

Example: **JOHN DOE Mfg. Co.** — 1,000 Employees

1,000 employees x $100 Regular Payroll deductions during the eight weekly payroll Accounting Periods of June and July	=	$100,000 Cash Quota 30,000 $70,000 (to be raised by sales of extra Bonds to at least 900 employees)

ORGANIZE • SOLICIT • DELIVER

The Treasury Department acknowledges with appreciation the publication of this message

★ ★ *This is an official U. S. Treasury advertisement—prepared under the auspices of Treasury Department and War Advertising Council.* ★ ★

ANOTHER SPECIAL BY PROGRESSIVE

Ask for design help. Item illustrated is a "special," of which no samples are available.

Special heads, threads, and finishes—on fastenings of any metal or alloy adapted to cold-upset—are Progressive's specialty. Weekly output: 25,000,000.

The PROGRESSIVE MFG. CO.
TORRINGTON 38 NORWOOD ST. CONNECTICUT

A WORD ABOUT
SUPERIOR UNIVERSAL
HEAVY DUTY Steering Connections

Known and used among the leading automotive manufacturers. Action-tested parts, with patented take-up feature at *all* connecting points, compensate automatically for wear while in service; thus minimize lost motion and resulting driver fatigue, provide safer, more efficient, and more dependable steering.

Investigate These Advantages
- Exclusive automatic take-up.
- Reduced steering effort.
- 20 years experience in steering geometry.
- Expert engineering on hydraulic applications.
- Complete facilities for PROMPT SERVICE when restrictions are lifted.

STANDARD RADIUS ROD

Patented automatic take-up and lock-cap construction. 3 sizes: 1¼", 1½", and 1¾" ball size; any length; ball openings for any installation.

STANDARD TIE ROD OR CROSS TUBE ASSEMBLY

Automatic adjustable ends to compensate for wear and eliminate lost motion in steering. 3 sizes: 1", 1⅛", and 1¼" ball; all lengths.

SPECIAL DRAG LINK

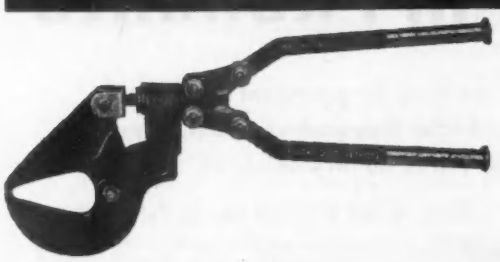
Standard link, standard tie rod end. Used where link is unusually short, causing high angular movement at vertical ball. 2 sizes: 1¼" and 1½".

STANDARD DRAG LINK

In standard construction or with take-up feature. 6 sizes: 1", 1¼", 1¼", 1½", 1¾" and 2", in any length up to 76"; any installation.

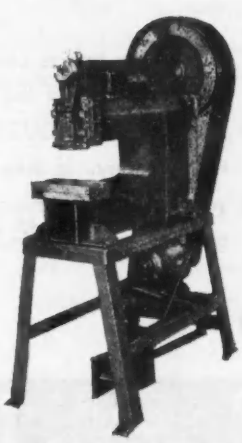
Write Today For Data To
SUPERIOR UNIVERSAL PRODUCTS
Division of Superior Coach Corporation Lima, Ohio

WHITNEY-JENSEN PRODUCTS
30 YEARS EXPERIENCE



AIRCRAFT RIVET SQUEEZERS

Standard Alligator, Crab Snake Head, and Pelican types for speedy, accurate, uniform setting of aluminum rivets up to 5/32" size. Pelican type (shown) in 6 sizes from 1¾" to 6" throat depth, other types in a total of 25 different sizes.



MOTOR-DRIVEN PUNCH

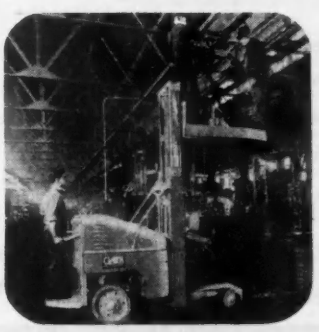
Heavy duty type for fast production work on small and medium size pieces. Capacity, 10 tons. Length of stroke 1¼". Stroke adjustment 1¾". Depth of throat, two sizes, 12" (No. 129) and 18" (No. 130). Box-section frame of welded steel plates. *Write for Aircraft Tools Catalog.*

WHITNEY METAL TOOL COMPANY
190 FORBES ST. • ROCKFORD, ILL.

How Marine Derrick Power Transmission Will Speed Production

Several time, labor and expense saving clutch improvements, developed by war emergencies, will be adapted for post-war products. For the duration, some of these improvements are not available in civilian products. But ideas are not rationed. Your future may depend upon re-designing your product for post-war markets. Let our engineers suggest new peace-time clutch applications using

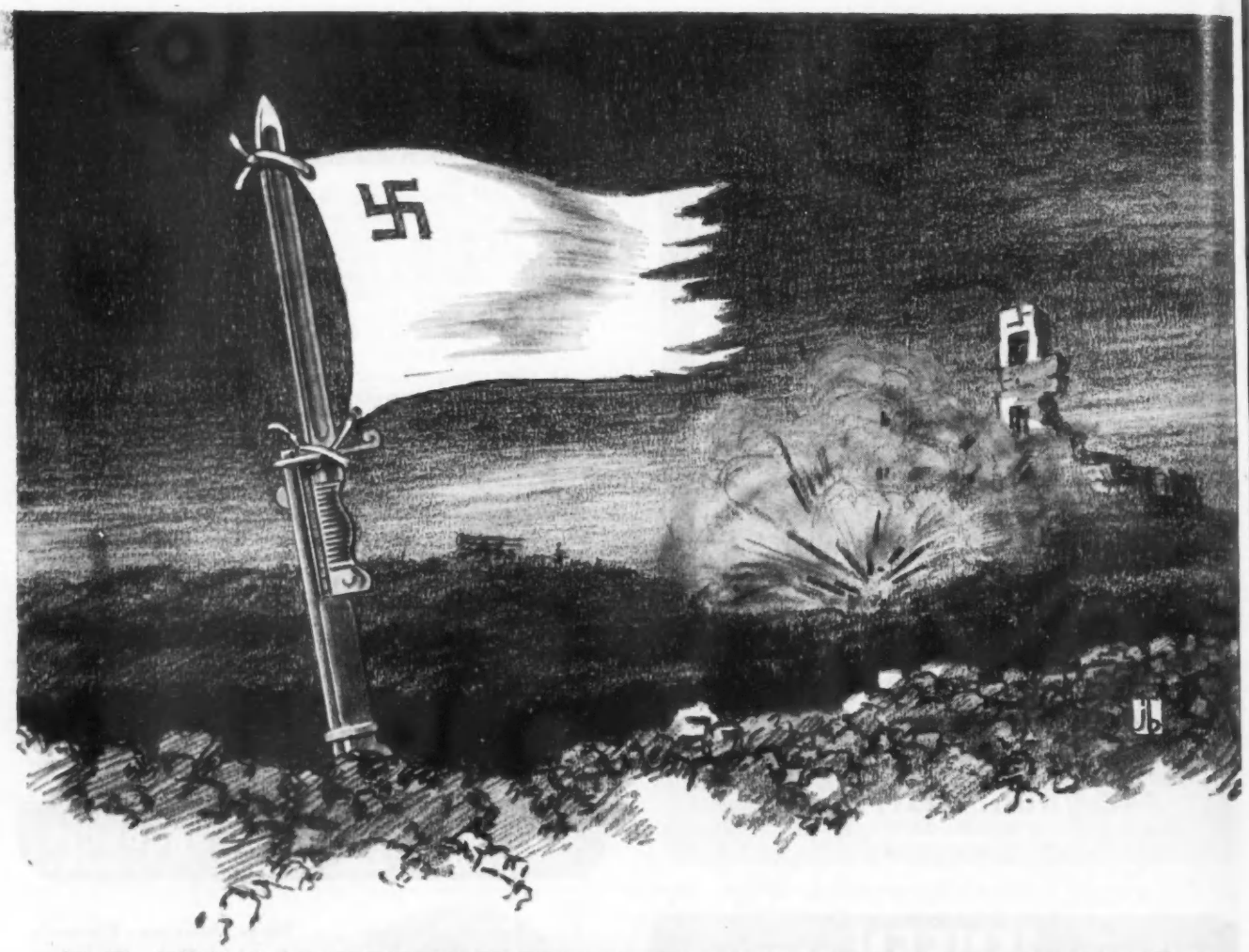
ROCKFORD *Industrial* CLUTCHES *and* POWER TAKE-OFFS



SEND FOR THESE HANDY BULLETINS ON POWER TRANSMISSION CONTROL

They tell and show how our engineers have made ROCKFORD CLUTCH and POWER TAKE-OFF applications that are saving power, time and money in a wide variety of industries. Give capacities, dimensions and specifications. Contain application diagrams. Product engineers need these bulletins.

Rockford Drilling Machine Division
Borg-Warner Corporation
315 Catharine Street Rockford, Ill.



AS THE DAY OF VICTORY APPROACHES

As the day of Victory approaches advertising in AUTOMOTIVE *and Aviation* INDUSTRIES increases in value.

As the day of Victory approaches so does the day when your war contracts will be coming to an end.

So does the day when you will have a competitive—and a *real* competitive—selling job to do, to a lot of strangers, some of whom have forgotten, many of whom never knew what your peace-time products were.

If it is not too early for prominent statesmen to make and publicize their post-war plans, it is not too early for you to do likewise—is it?

If they are getting ready for post-war activity—shouldn't you?

The closer peace comes, the more important it is for you to tell the readers of AUTOMOTIVE *and Aviation* INDUSTRIES what you will have for them to buy. If they already know on "V-day", you will have a running start in two of the world's greatest post-war industries.

AUTOMOTIVE *and Aviation* INDUSTRIES

A CHILTON Publication • Chestnut and 56th Streets, Philadelphia 39, Pa.

NEW IMPROVED PICK-UP no. 3000B

High Sensitivity—Constant Polarity—Operates at High Temperatures

The new improved Electro Pick-Up No. 3000B has a bayonet type socket which provides quick, reliable contact between connection cable and pick-up ★ Adaptor adjustments much simpler because of the use of 2 new set screws replacing the older type hexagonal nut. This new construction permits easy installation and removal from the engine with an ordinary socket wrench.

The pick-up coil has special impregnation that withstands continuous operating temperatures of 350° ★ Engineered to provide quick replacement of diaphragm or coil for extra economical operation and long life ★ When used with Electro Integrator, will provide indication of pressure variations in reciprocating engines, pumps, etc. Write for further information.

Electro
ELECTRICAL AND RADIO EQUIPMENT

PRODUCTS LABORATORIES
549 WEST RANDOLPH ST., CHICAGO 6, ILLINOIS

At Your Service
For CONTRACT PRODUCTION

★★To manufacturers of military or essential civilian products, whose own facilities are inadequate or unsuitable for certain items of production, requiring precision machinery, this company offers a dependable source of supply. This is not an unlimited service, of course, but our equipment of turret lathes, 3¾" automatics, millers, grinders, etc., is new and highly efficient, insuring fast and accurate production. *We may be in position to book your order immediately. Why not inquire?*

MERZ *Engineering Company*
INDIANAPOLIS 7, INDIANA

Not all synthetic gloves are oil resistant!

Hands in Danger are Safe in Stanzoils

Safety is cheapest — keep your busy factory "hands" safely at work, avoid lost production, costly injury claims. Stanzoils, the popular neoprene glove resists damage by oils, acids, caustics, last 3 to 7 times longer than rubber. Prevent skin irritation — workers like them. Standard styles, black, white. Write for current delivery data.

STANZOIL PIONEER

Synthetic Rubber Division
THE PIONEER RUBBER COMPANY
269 Tiffin Rd., Willard, Ohio, U.S.A.
New York · Los Angeles

MADE WITH DU PONT NEOPRENE

ALWAYS A SOURCE OF SUPPLY

For Machine Tools, Stamping Presses, Structural Machinery, Forging Equipment, Hydraulic Equipment, Air Compressors, Production Equipment.

OUR SERVICES ARE ALWAYS AT YOUR DISPOSAL

EMERMAN MACHINERY CORP. 875 W. 120th ST., CHICAGO 43, ILL.

For PRECISION-BUILT Small Pumps Specify

TUTHILL

Dependable Pumps For
COOLANT
LUBRICATION
HYDRAULIC
LIQUID TRANSFER
FUEL DELIVERY

Tuthill Pumps are Serving Army • Navy Air Force Merchant Marine

Tuthill pumps are known everywhere for their dependability, economy and long life as proved by hundreds of thousands in service today. These precision-built internal-gear rotary pumps are available in capacities from 1 to 200 g.p.m. and pressures up to 400 p.s.i. Write for catalog.

TUTHILL PUMP COMPANY
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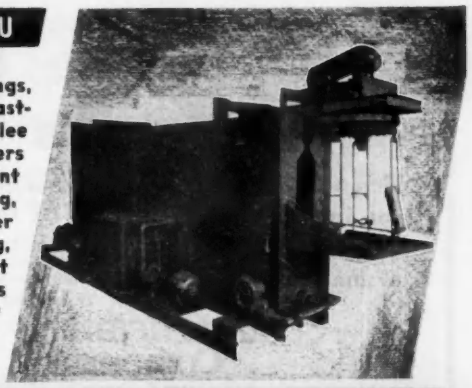

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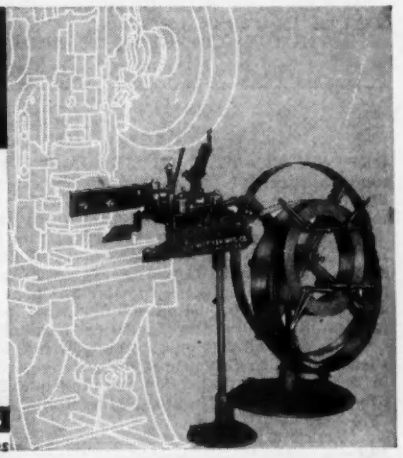

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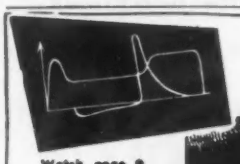

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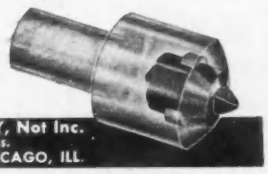

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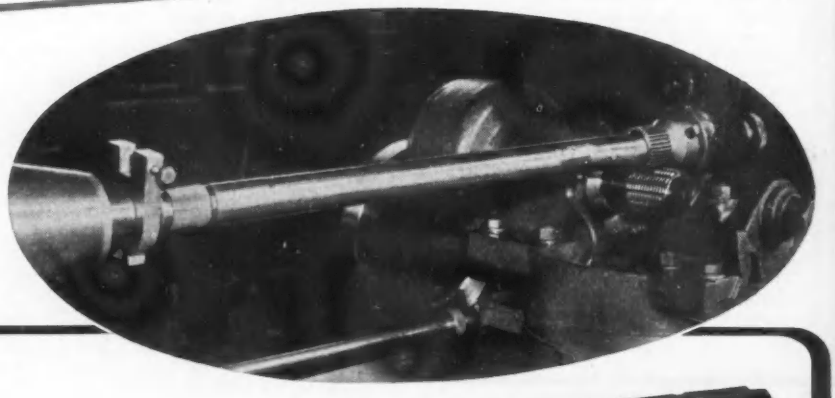
ANOTHER EXAMPLE OF

BARBER-COLMAN

HOBBING MACHINE PERFORMANCE

TYPE "A" LONG BED HOBBING MACHINE

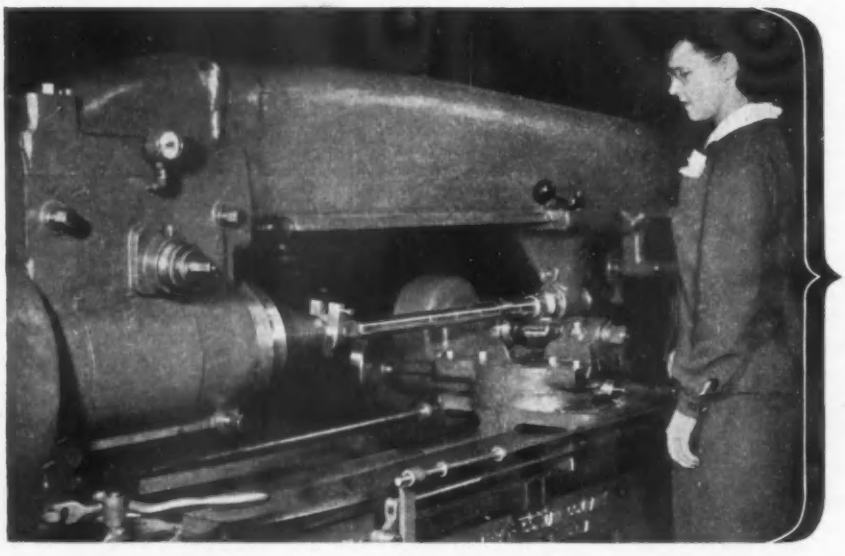
The machine used on this job is a Barber-Colman Type "A" Hobbing Machine with 40" Extra Length Bed, giving a working capacity of approximately 56" length. The Type "A" is a rigidly constructed machine that produces consistently accurate work on jobbing or production operations. For complete specifications, write for Type "A" Bulletins — F-1099 and F-1409.



ACCESSORY DRIVE GEAR . . .

. . . ON THE END OF A LONG, TOUGH SHAFT

This is an accessory drive shaft for a large, powerful radial aircraft engine. The material is AMS 6915 steel, with a hardness of 225-250 Brinell. The involute spline on one end of this shaft is 2.165" outside diameter by 1½" face and has 34 teeth of 16 pitch, 30° pressure angle. The work is held between centers and rotated by a dog driver (not shown) on the taper serrated end. Splines are hobbed concentric with ground shaft diameter within .002" full indicator reading.



70 PER DAY

Set-up and hob data on this job are:

Feed per rev. of work..... .0625"
Hob speed..... 70.6 r.p.m.
Production, one operator, two machines .....70 per day
Hob.....2¾" O. D. x 2¾" length, x 1¼" straight hole, ground, single-thread, non-topping.
No. of settings..... 9 to 10
Shift per setting..... .200"
Pieces per setting..... 4
Pieces per grind..... 40

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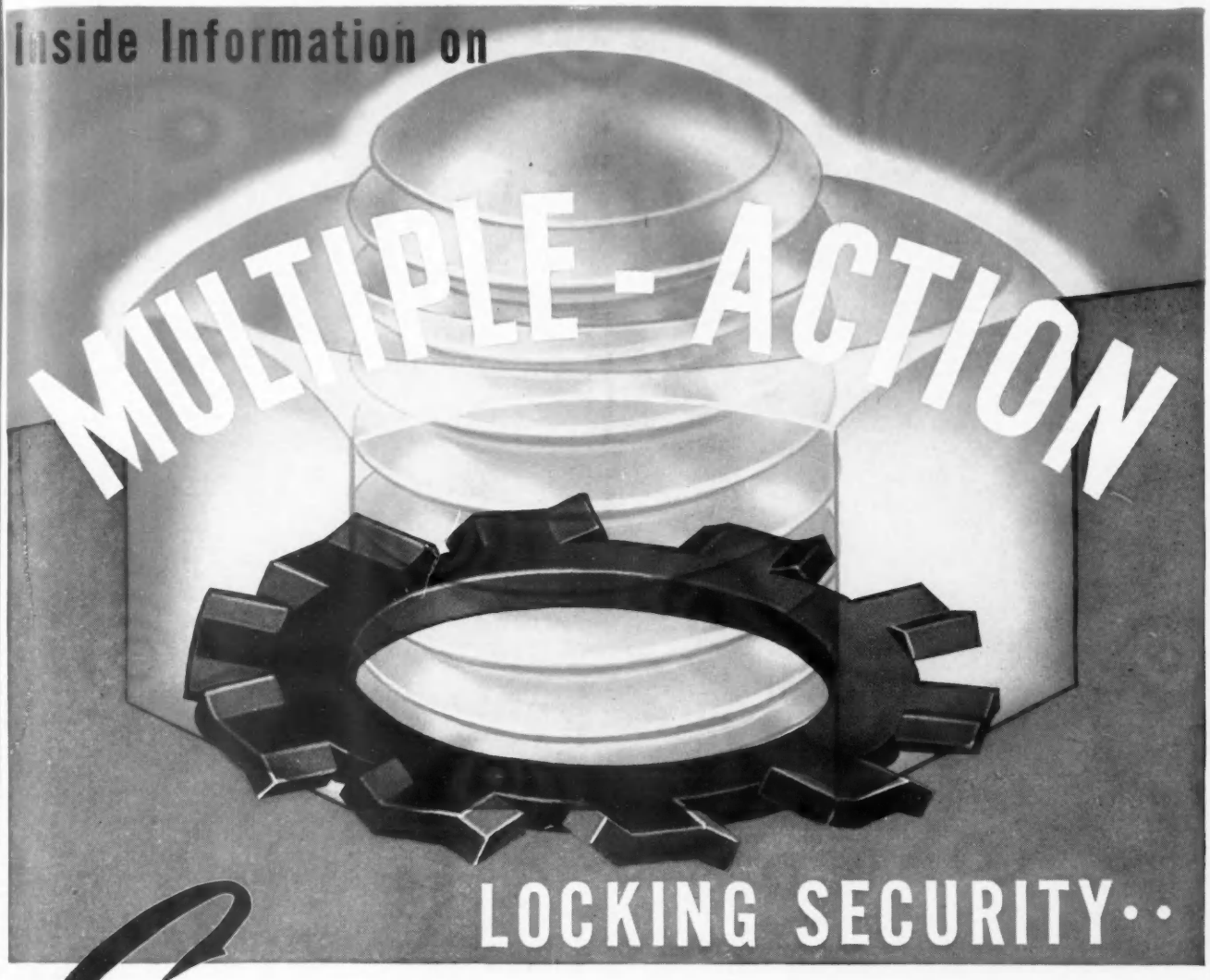

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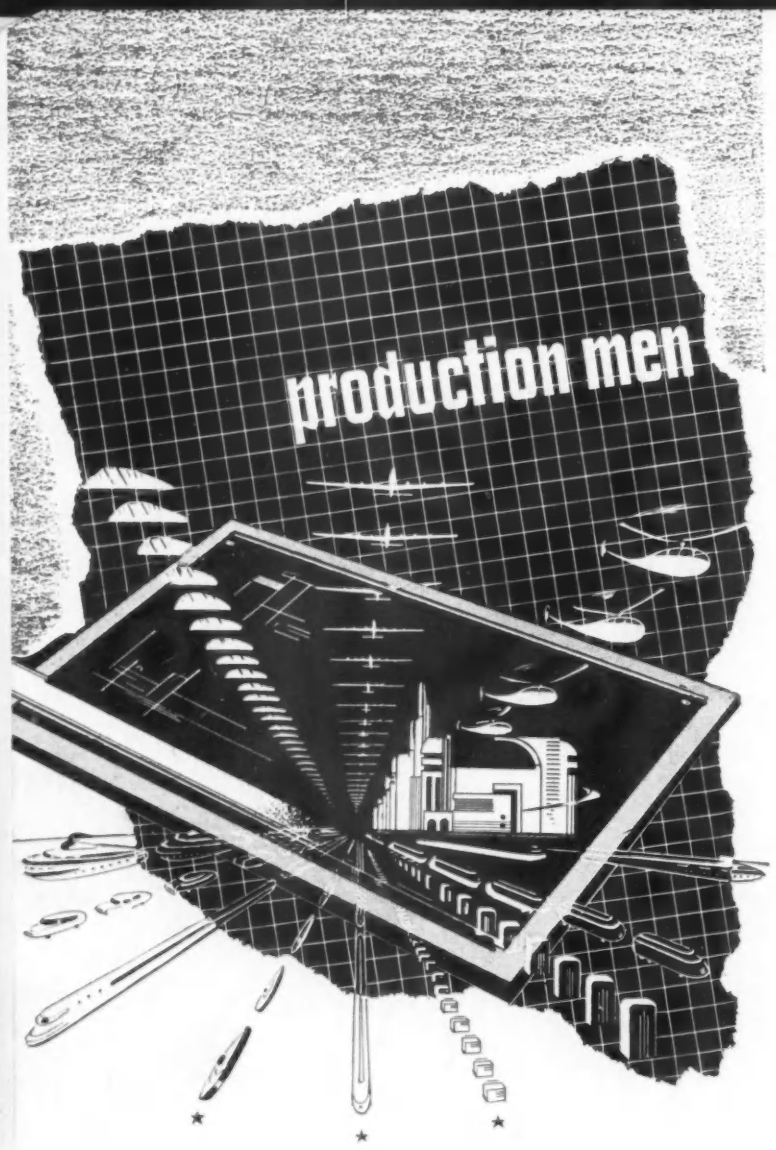

must shape the peace, too

Can you recall when America's war needs in terms of "ships, planes, guns and tanks" were broadcast to the nation? There were those of us then who said it couldn't be done. Impossible! Fantastic!

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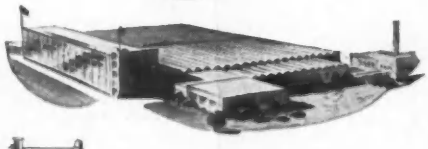

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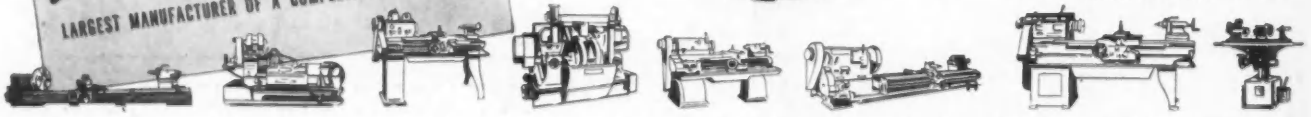

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